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DOG TRAPPING.

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In trapping dogs and foxes it is necessary to remember that this work must be carried out thoroughly and efficiently, if success is to be assured. A dog which has escaped from a carelessly set trap becomes wary or "educated" and develops a cunning which is difficult to overcome. The dog which has not previously had experience of a trap is usually an easy mark for an experienced trapper, but the dog which has escaped from a trap, particularly one which has been held by a trap for some time and possibly injured by losing toes or a portion of the foot, is the animal which becomes a curse and menace to a district.

Trapping has many aspects and must be studied from every angle, not merely to find out what to do, but what to avoid. A brief summary of the details to observe is given hereunder:—

(1) Secure the best type of trap available.

(2) Spend the necessary time to put the trap, as purchased, in perfect working order.

(3) Make sure trap is perfectly clean before setting.

(4) Poison the jaw of the trap thoroughly.

(5) Set the trap carefully and thoroughly.

(6) Avoid setting traps near rabbit warrens, on paths or roads, near waters or places where other animals are likely to interfere with them. (Sprung traps make a dog wary.)

(7) Do not set traps too close to carcases of animals or birds. These attract crows, cats etc. If a carcase is used for a trail, do not leave it too close to trap.

(8) Avoid using meat, fat or oily decoys. Never use chemically prepared decoys where other animals are about; these attract other creatures as well as dogs.

(9) Remove and burn all dog carcases when caught. Although these often prove a useful decoy, they educate some dogs, which become very shy if they find carcases of their mates lying about.

TYPE OF TRAP.

The type of trap found most efficient, and therefore recommended, is the seven-inch drop-plate trap, as illustrated in Fig. 1. Attention is drawn to the fact that there are a number of traps on the market inferior both in quality and design. Obtain the best quality trap obtainable, of the drop-plate type.

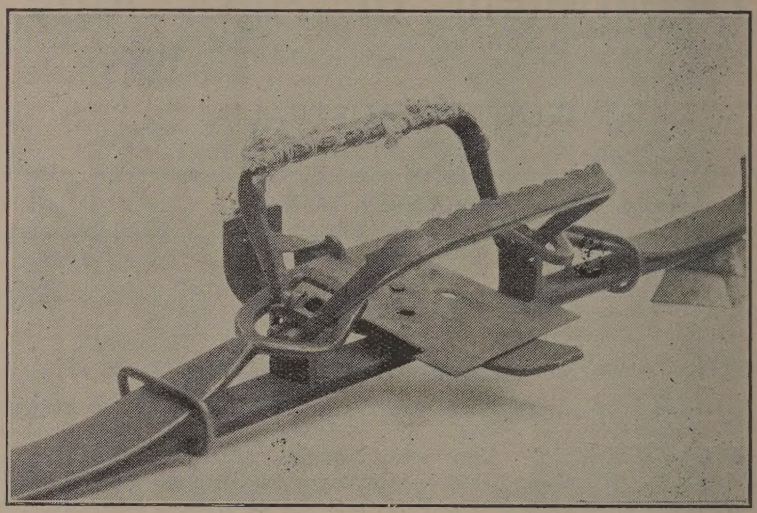

Fig. 1.—Showing teeth of jaws cut off, leaving last tooth nearest the spring as a short stub to prevent jaws meeting closely.

METHOD OF TRAPPING.

The method of trapping described in this article is called the "decoy method," that is, placing a decoy such as dog manure or other preparation in a selected spot, and placing a trap before it in such a manner that the dog, when approaching the decoy to smell it, treads on the trap, and in setting it off, is caught. This is the most satisfactory method of securing a dog with the trap. It also has the added advantage of avoiding, to a great extent, the trapping of other creatures, which are not wanted. The method known as "chance trapping" is not recommended. Chance, or "blind" trapping, is merely burying a trap on a path or in the bed of a creek, or along tracks and roads for the dog to tread on by accident. This method helps to educate dogs. A dog may easily tread on the jaw of the trap so set, or on the looped end of the spring between the ends of the jaws, and touching the edge of the plate with his toes or claws. When the trap is sprung, the jaw of the trap, or spring (as the case may be), will force his foot up and merely "nip" his toes, or force the foot clear, thus educating without securing him. It also leaves the trap unprotected from other animals or passing traffic. Some time ago, whilst driving a car along a bush track, twenty-two traps were sprung in half a mile. The trapper in this case not only had his work for nothing, but left his traps open to possible damage, and also, in the event of a dog or fox coming along shortly after, gave it an excellent education. This method of "chance" trapping is not recommended and should be avoided.

ADJUSTING THE TRAP.

There are a few adjustments to be made to the trap, as purchased, in order to make it more efficient. These are all simple, and only require to be checked up occasionally to keep the trap up to the standard required. Settlers frequently ask why any adjustments should be necessary, or advisable, and are advised that makers send out a standard type trap, which is not as efficient as it can be made by men who have spent years of their lives in the practical work of trapping dogs, and have discovered little points which ensure success.

An improved type of trap has been patented but has not been placed on the market as no firm could be induced to spend the money involved in its manufacture. It is a pity that this should be the case, as traps are in constant demand and it is believed these would sell readily. This being the position, trappers must make what adjustments are found necessary to the type of trap obtainable on the market.

First, remove the jaws by clamping down the springs with the loops or clips provided for the purpose, and lever jaws out. Cut off the teeth with a cold chisel (an old axe will do), but leaving a small stump of tooth at each end of the jaw, as shown in illustration (Fig. 1). When the jaws are replaced, and the trap closed, the stumps of the teeth should hold the jaws about quarter of an inch apart, as shown by the irregular black line in Fig. 2.

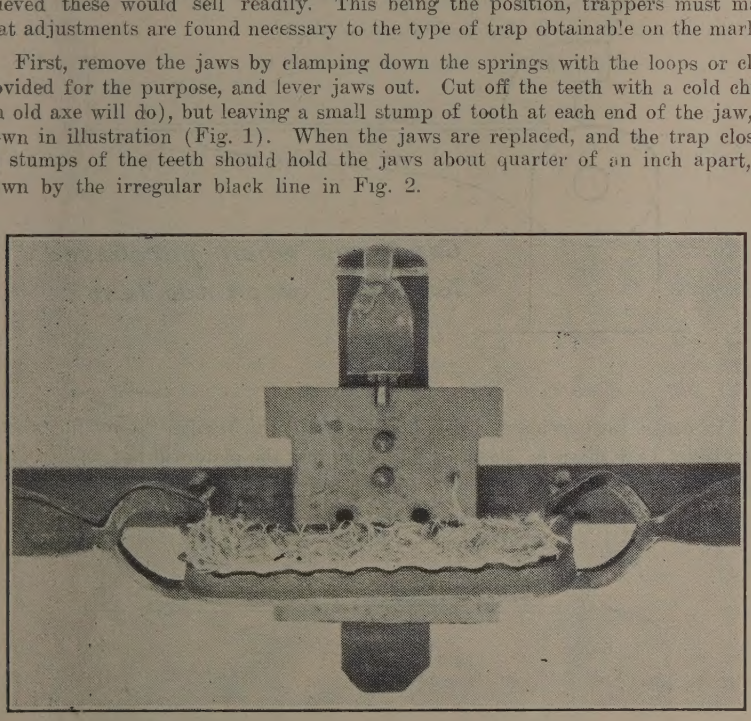

Fig. 2.—The irregular black line shows gap about ¼in. wide between jaws formed as result of cutting off points of all teeth except end teeth nearest springs, which prevents jaws meeting closely.

The sharp teeth originally provided often very quickly cut off the dog's leg. With the teeth removed, and the gap left between the jaws, the sinews of the leg will hold for a long time, even if the leg is broken.

Unless the trap as purchased provides for the following, it must be adjusted so that—

(a) the jaws work freely up and down;

(b) provision is made for only a short drop of plate before going off;

(c) the plate of the trap will carry a weight of two pounds on its centre without going off;

(d) the free or back edge of the plate is about 2 inches from the bottom cross bar when the trap is set.

With regard to (a), the jaws should be free to move up and down when the springs are clamped down, but should have no end play, otherwise they may spring out of place when the trap is set off. The jaws are soft steel and easily hammered into the required shape.

A sketch of the plate with the catch as when purchased is shown in Fig. 3.

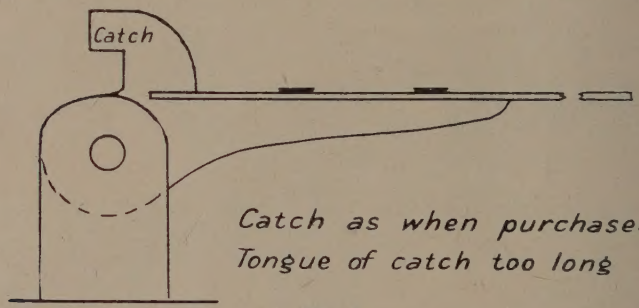

Fig. 3.

In order to provide for (b), file the catch which grips the tongue when the trap is set, very short, as shown in Fig. 4, so that the plate will not require to drop very far before the trap is sprung by the dog.

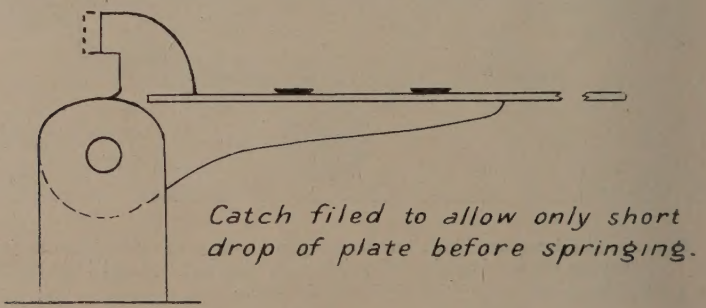

Fig. 4.

When the trap is set the plate should carry about two pounds on the centre without going off; this is to ensure the dog having a considerable weight on the plate when the trap is sprung. This gives him no chance to lift his foot when he feels the plate move. It also helps to avoid catching rabbits and other small game which are not wanted. The adjustment necessary to ensure that the weight of at

least two pounds can be carried in the centre of the plate without springing the trap can be made only by filing the catch at a sharp angle as shown in Fig. 5. The

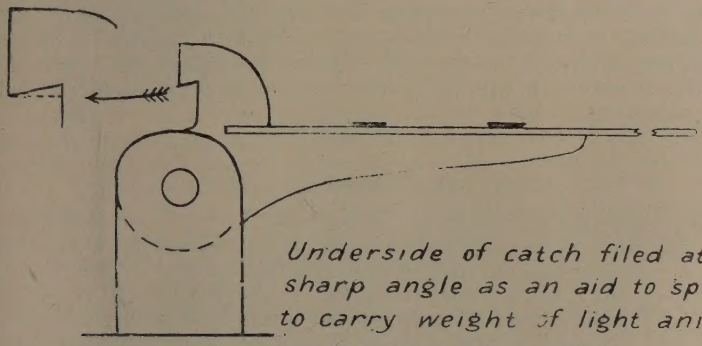

Fig. 5.—Showing method of filing catch.

ordinary tomahawk usually carried by trappers often weighs 2 lbs., and when this is so, by loosely holding the end of the handle and placing it in the centre of the plate it can be used to test the weight-carrying capacity of the trap. In order to ensure that the trap is set uniformly each time, the tongue should always be pushed well home, right to the back of the catch.

The correct height of the plate is about 2 inches above the cross bar below, the measurement to be taken at the extreme back edge of the plate, *i.e.*, farthest from the tongue. This will allow plenty of room for the drop for the plate when the dog steps on it. If the back edge of the plate is not set at the height recommended, any sand or loose material sifting under the plate will prevent it being depressed sufficiently to release the catch from the tongue, and so spring the trap. A trap with the plate set at the right height is illustrated in Fig. 6. To make the adjustment referred to in (d) it is necessary to bend the angle iron, to which the

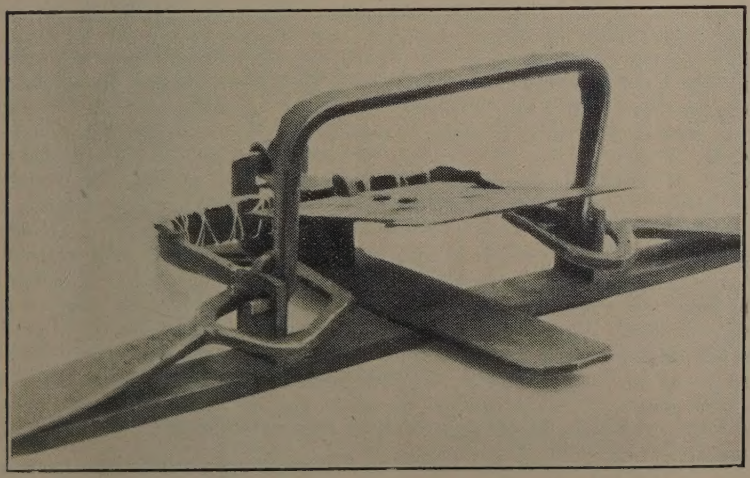

Fig. 6.—Shows height of plate, about 2in. above bottom bar.

tongue is attached, outwards to raise and inwards to lower as required. This can easily be done with a wrench or b ystriking the corner of the bar a sharp blow with a hammer, taking care not to damage the tongue. Set the trap, hold the plate up firmly against the tongue with the fingers, and tap back the tongu egently towards the plate. This will free the inside of the rolled edge of the tongue from the metal bar to which it is attached, leaving it to revolve freely when the trap is set off.

"KEEP THE TRAPS CLEAN."

Always clean traps thoroughly to remove smell. This applies more particularly to a trap which has already made a catch. A trap should be free of any strong smell, such as grease, oil, blood or smell of a dead animal. The smell on the trap will often cause a dog to scratch a trap up. Once a dog has located a trap in this way, he will look for them and usually proves a very hard animal to deal with. The only smell required is the decoy placed for the specific purpose of attracting him, and every effort should be made to prevent his attention being drawn from it, either by sight or smell. Some years ago, a station manager asked for assistance to destroy some dogs which were doing a great deal of damage on his property. He had already trapped two dogs but was unable to catch any others. He stated the dogs were scratching the traps up. On taking up some of the traps it was found that not only were the traps dirty, but that the medium used to carry the poison for the jaws of the trap was greasy wool. This carries a strong smell and was probably the reason why the traps were dug up. The traps were thoroughly cleaned, clean cotton waste used to carry the poison for the jaws as recommended. The gratifying result was that the remainder of the dogs were caught in a few days.

POISONING THE JAWS OF THE TRAP

For this purpose strychnine is used.

To poison the trap, bind a piece of clean cotton waste on that jaw of the trap which is held down by the tongue when the trap is set. This is clearly shown in the illustrations one and two. The reason for using this particular jaw is because it is farthest away from the dog's nose when he approaches the trap, thus minimising the possibility of any slight smell on the waste attracting his attention. One jaw is quite sufficient to poison, providing it is well done. The waste should be secured very tightly with thin wire. If waste is not obtainable, use thin cloth or other material that will tear easily. Do not use string for tying, as it is too easily broken. Wire is the best. To prepare the waste for the poison smear golden syrup, treacle or honey on it, working it in thoroughly with a knife. Then apply the strychnine. The minimum amount used is as much as will lay on a sixpence, but it is better to use more. Work it thoroughly into the waste and syrup. There is a general idea that it is possible to place an overdose of strychnine on the trap; this is quite an error; it is the practice of the writer to use sufficient to kill twenty dogs. The only time when this plan of using plenty of poison fails is when it is not properly done. When a dog is caught in a trap, his natural instinct is to bite at the trap to free himself, and in so doing he will swallow any small piece of material he bites off the trap. The aim, therefore, is to use a material that will tear away in small pieces. If taken in small pieces the dog will often swallow the whole of the waste, wire and all. By doing this, he receives sufficient strychnine to destroy himself.

A trapper recently advised he could not obtain results from the poison on the trap, and it was evident something was wrong with his methods. On examining a

poisoned trap, it was found he was using a strong piece of cloth loosely attached to the jaw with a piece of string. The result was that when the dog commenced biting at the trap, the string broke, the strong cloth came away in one piece, and the dog dropped it. When this was explained to him, the cause of his failure to obtain results was obvious. By binding the waste tightly on with wire there is no chance of the dog removing it in one piece. He must tear it away in small pieces and so poison himself. Another instance of the value of poisoning the trap occurred some years ago in the Wiluna district on the bank of a deep creek. The bed of the creek was some twenty feet below the level of the surrounding country and was very stony, containing a permanent pool of water. The walls were torn out, cavern like, for some miles. A narrow path led down through a cleft in the bank to the water. At the time, this was a favourite watering place for dingoes. Two traps were set on the bank above, close to the path. The mate of the trapper was new to the job, and very keen to see a dog trapped. The camp was about 100 yards away, in the edge of the scrub, and a clear view was to be had of the place where the traps were set, but the trappers could not be seen by any approaching animals. Early next morning two dogs were sighted coming down the bank of the creek. This being the first time traps had ever been used here, it was confidently expected these dogs would be easy to trap. (In fact, nine dogs were trapped in four days.) Following the path, the leader, a big cream-coloured dog, soon scented the decoy, and went straight into the trap. He yelped loudly, and made off, savagely biting at the trap. Rolling over and fighting with it he disappeared over the bank of the creek, crashing on to the rocks below with great violence. On clambering down the bank, the trap was found with one of the jaws broken; this had occurred when the dog fell, and released him. Some of the poison had been bitten off, but it was not thought that he had eaten sufficient to destroy him. However, it was decided to track him and find out. The creek opened out into a sandy bed, making tracking comparatively easy. About three-quarters of a mile from the place where he left the trap, the dog was found lying dead. He had simply dropped dead in his stride. The short time he was in the trap proved his undoing, the galloping evidently accentuating the action of the strychnine, as he made no struggle by taking fits as usually follows the action of strychnine poisoning. Had that particular trap not been well poisoned, the dog would have got away and thus become another "educated" animal to be dealt with later.

Poisoning the trap has other advantages besides the actual destroying of the dog. It prevents him from taking the trap very far, avoiding the risk of losing it, and saves the trapper a lot of time tracking or searching for it. It also prevents damage to the trap itself. In rough, stony or heavily timbered country, traps often suffer damage from the dogs dragging them over stones, stumps and dead timber. This applies to the more delicate parts of the trap, such as the plate and tongue. Years ago, before the poisoning system had become as efficient as it is to-day, traps were damaged by being dragged about to such an extent that it was necessary to take them to a forge to properly repair bent, twisted or broken tongues and plates, and, when working in the out-back areas, this often put one or more traps out of action for some time. When working with pack horses, only a limited number of traps can be carried, and the loss of the use of these traps out of action was quite a serious matter. As a rule, when poisoned as recommended, the traps will be found quite close to the original spot where they were set.

STUDYING THE DOG'S MOVEMENTS.

Having prepared the trap, it is necessary to do some preliminary work to select a suitable site for setting it. The first thing to do is to find the beat of the dog, and form some idea as to his habits. This is absolutely essential to obtain the best

results. The usual procedure of an experienced trapper is what might be termed "localising" the dog or dogs, as the case may be. That is, to explore the surrounding country for some miles. To do this thoroughly, it is necessary to find the quiet spots where dogs camp in the day time, where they drink, hunt, and during the breeding season, where the pups are likely to be found. Dogs invariably have favourite camping places, and these must be located and dealt with to clean the dogs out of a district. It is not sufficient merely to trap dogs as they appear on the property. One must work farther afield, and on their breeding grounds, to stamp them out.

To do this, the movements of the dogs must be traced by tracking. Dogs like good travelling ground, such as sandy creek beds, roads, paths or similar places to protect their feet and make progress easier. Wild dogs and foxes are nocturnal animals, that is, they do most of their travelling by night, and will avoid bad travelling ground as much as possible. This is of great assistance to the tracker, and dogs can be trailed many miles in this way. The older the dog becomes, the wider the radius of his beat extends, and the knowledge he acquires is remarkable. His intelligence is wonderful, and can only be appreciated by careful and patient study of his movements. There is much to be admired in the thorough and efficient manner in which he operates. To the average sheepman, he is merely a ruthless killer, to be exterminated as quickly as possible, but to men who follow his movements with keenest interest, he proves an elusive and clever creature, worthy of the greatest skill and ingenuity that the trapper can use against his cunning. Because this is realised, there are times when a keen regret is felt that the successful efforts of the trapper makes it necessary for them to be the final cause of his downfall. The dingo is never at a loss, both in securing food and water, quiet camping places, and good travelling. Contrary to the common idea, he does not move about the country in a haphazard fashion but is very regular in his movements, working out a definite plan of campaign.

The nature of the locality which he inhabits, also plays a very important part in regard to the extent of his wanderings. For instance, in the dry open spaces of the inland pastoral and desert country, a radius of 40 or 50 miles is quite a common beat for old dogs. Scarcity of food and water, and well protected breeding places, make this necessary. This does not apply to the rough coastal and heavily timbered areas of the South-West. Abundance of food and water, plenty of natural cover, render this unnecessary, and the difficulty of travelling through thick undergrowth retards progress. Dogs have regular visiting places, throughout the entire length of their beat, and these are the best places to set the traps. Corners of cross-roads, or the junction of two roads, gate-posts, corners of paddocks, along fences, near dams, soaks, rocks, old camps, along creeks, watercourses, around the edges of swamps or salt lakes, are favourite haunts. Old sandalwood camps where piles of chips have accumulated have a peculiar attraction for dogs. Possibly the smell of the sandalwood chips is the reason for this. If you look carefully round these places, you will find where the dog has relieved himself, and scratched on the ground, usually near the foot of a tree, post, small bush or tuft of grass. This is the spot for the trap.

SETTING THE TRAP.

Place the trap on the ground with the tongue nearest the post or bush, about a foot from it. Mark out the shape of the trap on the ground as a guide. Place a bag on the ground to kneel on, and whilst digging the hole for the trap place all earth and debris removed upon it. The hole should be a little larger than the trap, and deep enough to place the trap slightly below the surface level. When the hole

is ready, place a small peg in each corner of the hole where the nearest jaw is to rest. This is shown in Fig. 7. These pegs should be driven in firmly, to come

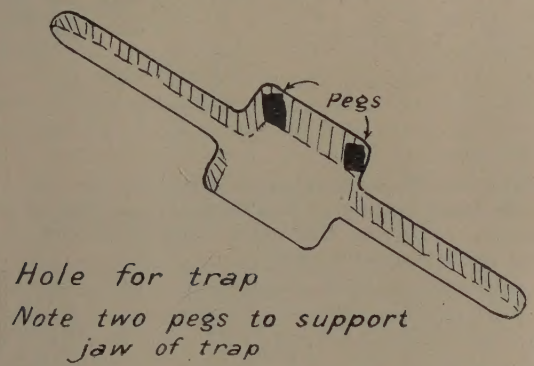

Fig. 7.—Hole for trap, showing pegs on which jaw nearest the trapper is set.

under the extreme ends of the jaw, and prevent possible interference with the plate, and should be low enough to allow the jaw, when resting on them, to be slightly below the surface level.

When the trap is placed in the hole, it is necessary to tilt it towards you, as in Fig. 8, to bring the plate level, parallel with, and slightly below the

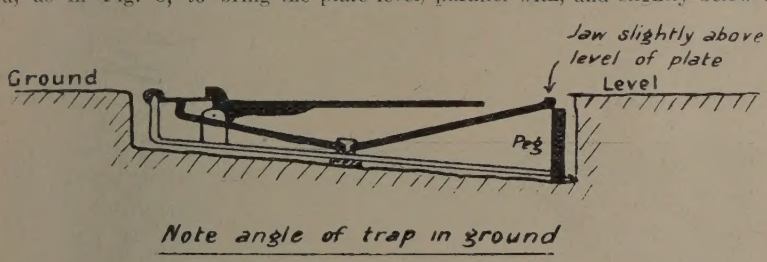

Fig. 8.—Trap set in ground.

surface. Raise the jaw before doing so. When the correct level has been attained, lower the jaw on to the pegs, making sure it is seated firmly upon them. The top edge of the jaw should be a little higher than the plate level. Never on any account leave the jaw below the plate level. This helps to insure the animal having his foot inside the jaws before the plate can be depressed. The raising of the outer jaw has also another advantage. When the jaw is raised, it is lifted clear of the looped ends of the springs. This leaves the entire pressure of the springs to bear on the jaw which is clamped down by the tongue. When the dog treads on the plate, his weight presses it down, releasing the tongue. The pressure of the springs bearing entirely on the inside jaw, forces it up. Continuing the upward movement, the springs come in contact with the second jaw, forcing it upward also, till the jaws finally grip the dog's leg. This gives the trap a tendency to close more rapidly than is the case when both jaws are resting on the springs. Rapid action is essential in the movement of the trap, and no pains should be spared in endeavouring to bring this about.

It may be necessary to try the trap in the hole several times before the correct fit is obtained. Before finally placing the trap in the hole, make sure the tongue is fitted correctly in, and to the full depth of adjusted catch, also that the rolled eye is clear of the metal, as previously described. Now take hold of the two clips or loops which are used to clamp the springs down when setting, and draw them back towards the ends of the trap as far as possible. Lift the trap by the ends, still gripping the loops with the thumbs, and place it in the hole. By doing this, one or more of the loops will not be left holding down the springs, a common fault with inexperienced trappers.

Trappers have been known to place the trap in the hole, and with the idea of embedding it more firmly in the ground, move it endwise, allowing the clips to slide along, partly holding the spring, thus preventing the trap from properly closing. This is sufficient to allow a dog to escape.

When the trap is firmly seated, cover the ends to within two inches of the jaws with earth or sand, pressing down firmly; take some dry horse manure, dead leaves or other suitable material, and with a small stick tamp this all round the jaws and over the looped ends of the springs, taking care no small stones or sticks, etc., fall in the trap, which may prevent it closing. The use of horse manure or leaves where directed will not allow the earth or sand to fall into the trap, and also prevents the earth from setting round the jaws of the trap. This applies more to heavy loam or clay country rather than sand. After rain, loam or clay dries hard and sets like cement, often preventing the trap from going off, or making it sluggish in motion. The manure or leaves keep the jaws of the trap free to move, and it will still be efficient even after heavy rain.

Now take some thin twigs, strong grass or rushes, about three inches long, and arrange round the jaws and plate, to form a framework to carry the paper. This is shown in Fig. 9. Take two small sticks about as thick as a wooden match, and place one at each end of the outer jaw, on the outside of the jaw, touching it. These can be seen in Fig. 9 at the front corners of the plate and also in Fig. 14 with a

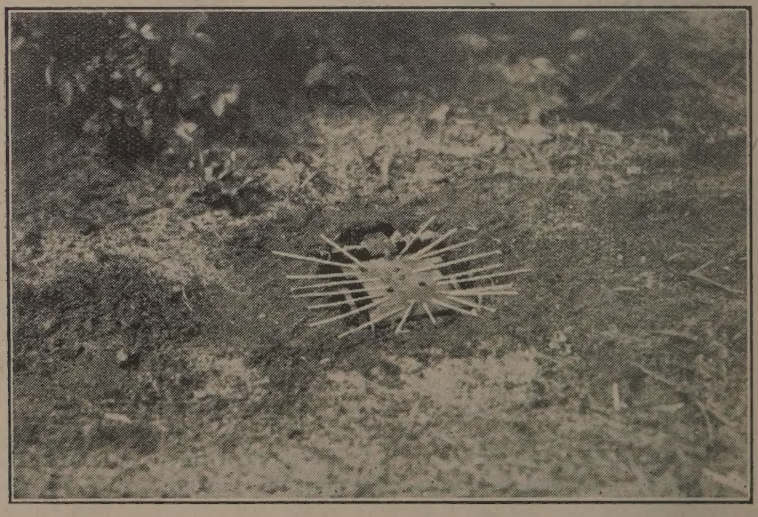

Fig. 9.—Trap prepared, with twigs to carry weight of paper with covering soil.

thin stick against them. Leave these pegs protruding about half an inch above the surface level, for reasons which will be referred to later. The plate should now be covered with paper. For this purpose two pieces, overlapping an inch in the centre, are preferred rather than one. Each should be 9 inches long by 5 inches wide; these are the correct measurements for a trap of this size, but of course if other sizes are used, the size of the paper will need to be in proportion to the size of the trap used, keeping in mind that the paper covering should extend 1½ inches clear all round the jaws, with an inch overlap in the centre. Ordinary newspaper serves the purpose very well, but avoid using stiff, or strong paper. This may retard the working of the trap, and is not so easily tapped down on to the plate as described later.

In Fig. 10 two pieces of paper are shown laid loosely over the trap, with the join across the centre of the trap, parallel with the springs. To place the papers in position, lay the first piece over the back or tongue portion of the trap, leaving it extending about 1½ inches beyond the back of the tongue. Lay the second piece

Fig. 10.—Trap covered with two pieces of paper, overlapping in centre and ready to receive the covering soil.

over the front portion in a similar manner, overlapping the first piece across the centre of the plate. Make two small slits or holes to allow the two small pegs previously referred to to protrude through the paper. Cover the paper completely with powdered earth or sand, of the same colour as the surrounding surface. To do this it is a good plan to make a small sieve by punching holes in a tin about ⅛ of an inch, or sufficiently large enough to allow the sand to run through freely. A "Trufood" milk tin, or similar tin, is excellent for the purpose. By using this, it prevents large gravel or small stones etc. from falling into the trap and also distributes the sand evenly over the paper. Do not cover more heavily than is neces-

sary, providing the paper is well hidden. Fig. 11 shows the first covering with the two pegs still in view. Take a stick with a flat end and tap gently all over the

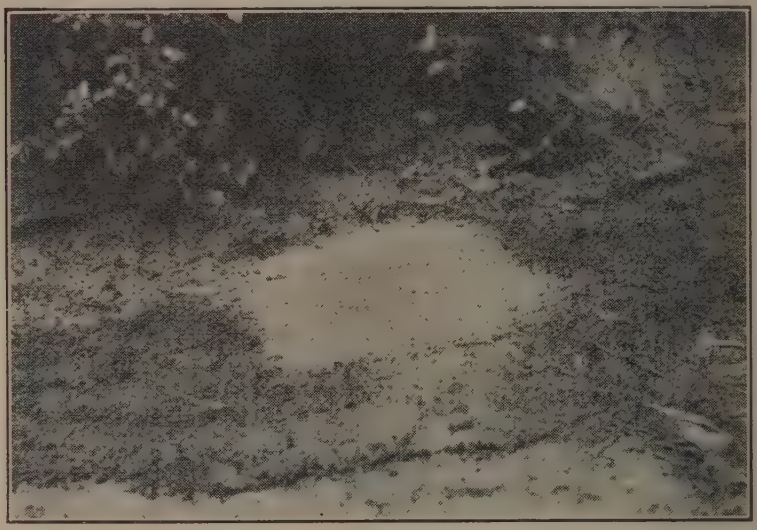

Fig. 11.—The first covering of soil, before tamping.

plate, using the stick endwise. It will be seen that this disturbs the paper, exposing parts of it, particularly the corners, as shown in Fig. 12. The tapping causes the

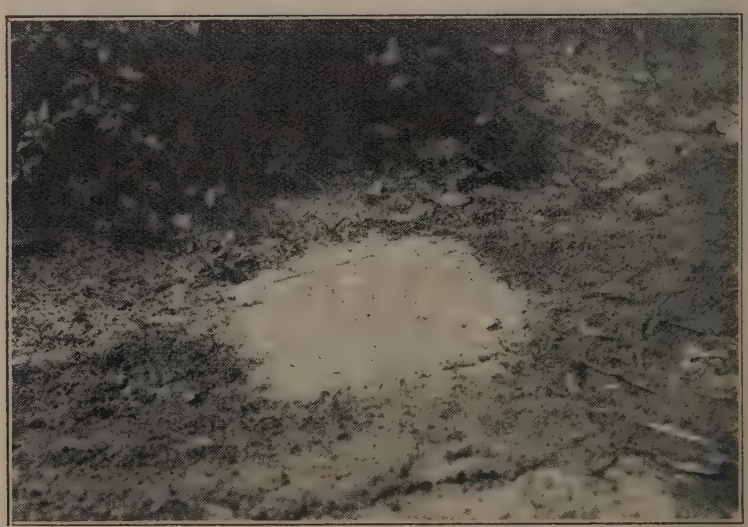

Fig. 12.—First covering of soil, after tamping. Paper showing through in places.

paper to bed down firmly on to the plate. To avoid overloading the paper with sand, smooth the surface over with the stick, apply more sand if required, and tap the same as before. After this operation has been repeated once or twice, you will find little or no movement. If this tapping were not done, a small animal such as a rabbit, cat or bird, walking on the trap would disturb the covering without setting the trap off, and spoil the work.

When this part of the job has been done properly, take some small dry leaves, or other suitable material, and sprinkle over the surface to make the place where the trap is set look as natural as possible. Be careful not to use anything that will interfere with the working of the trap, or turn the dog off. This is shown in Fig. 13, the two small pegs being the only visible sign of the

Fig. 13.—Trap finally covered with leaves and debris so that surface appears natural.

trap and marked in the illustration by two small white x's. Take a few dry sticks or twigs such as might be lying about (not freshly broken sticks or green timber), place these around outside the jaws and over the spring, to prevent the dog approaching the decoy from the sides. Don't over-do it (you are not making a sheep yard); it takes very little to turn a dog off. Take a small straight stick, no thicker than an ordinary lead pencil, about eight inches long and place it along in front of the two little pegs previously referred to, and to which attention was drawn in the illustrations. It will now be observed that these pegs serve a double purpose. Now the trap is covered, they first indicate the exact position of the jaw of the trap, and next, the additional and specific purpose for which they were put in, to prevent the stick which is placed against them from being pushed into the trap. The pegs are clearly shown in Fig. 14. This stick is placed in this position to ensure that the dog when approaching the decoy will place his foot on the plate and not on the jaw of the trap. This is ensured because a dog will not tread on even a very small stick if there is a clear place to put his foot. Wild dogs are particularly careful of their feet, as their very existence largely depends on them. The stick is

lying along the edge of the jaw. This will break the dog's step, and prevent him treading on the jaw. As previously explained, it is quite a simple matter for a dog to accidentally tread on the jaw of the trap, press the end of the plate down with his toes, and set the trap off.. The rising jaw forces the foot upward either clear of the trap, or merely "nips" his toes. By placing this stick in position, this may be prevented.

In the illustration 14, white sticks were purposely used to make a strong contrast in the illustration. The trapper would use his judgment, and in consequence

Fig. 14.—Twigs placed on sides of location of trap to prevent dog from approaching from side; straight twig in front of trap and against pegs to ensure dog stepping over it on to plate of trap.

the sticks would harmonise with those in the locality. In the illustration, also in order to emphasise the need of them, more sticks were used than were absolutely necessary. Here again the trapper must use his judgment and make things look as natural as possible.

DECOYS.

Never tie or secure the trap in any way, as this would give the dog something to pull against and he would soon free himself, even at the expense of a portion or even the whole of his foot. If the jaw of the trap is poisoned, as detailed later, the dog or fox will not take the trap very far.

It might be mentioned here, that trapping is a time job. This does not mean a great deal of the trapper's time, but the traps may be set for some time before the dog comes along. The longer a trap is set, the more certain it is to do its work when the time comes. Wind and rain will have their effect in disposing of smell and tracks. It is necessary, therefore, to provide for this by making a thorough job of the setting and taking sufficient time to do it thoroughly; "more haste less speed" applies specially to dingo and fox trapping.

Place the decoy on the ground in front of the bush which is directly behind the trap, about 12 or 14 inches from the front stick. This is also shown in Fig. 14 and indicated by a small white x. Do not plant it in the bush, but leave it where it can be easily seen.

Some trappers prefer to place the decoy much farther away, but it is found that a dog will invariably place his foot within a few inches of a decoy if it is placed on the ground, providing, of course, there is nothing to make him suspicious of danger. A few pieces of dog manure, with a little urine, if obtainable, poured on it, is an excellent decoy. Chemically prepared decoys are not recommended, dog products are the best. Having set the trap, remove all surplus earth and other signs of disturbance, obliterate tracks etc., with a piece of brush, and, if possible, sprinkle with water lightly over the place where the trap is set. This will prevent the leaves, etc., from blowing about, also assist to remove all smell and tracks. Under ordinary circumstances a few days is sufficient to remove all trace of human smell, but it is as well to assist as far as possible in removing it, hence the use of sprinkled water.

INSPECTING THE SET TRAPS.

When inspecting traps, do not approach nearer than is absolutely necessary to make sure there is no sign of disturbance. Watch carefully for any sign of paper showing. If this should occur, cover again with as little handling as possible. If it can be avoided do not inspect traps too early in the morning, or late in the evening. This is a very favourable time for dogs to come to the trap.

Wild dogs lay up during the day, and move late in the evening, usually after sundown, throughout the night and early in the morning, usually camping after sunrise.

If there is more than one dog about, it is a good plan to set traps in pairs, about a chain apart. Often one dog will get caught, and the other will wander about, awaiting its mate, and finally locate the second trap. If this does not happen, the second dog will often come back the next night or two, and the other trap is ready to do its work. Many pairs of dogs have been secured in this way.

CARE OF TRAPS AND POISON.

Traps should be given the same care as any other implement the settler uses. Unfortunately, this is not always the case. Only recently a visit was paid to the property of a settler who had the reputation of being not only a good farmer but a very careful and methodical man with his machinery, etc. Generally this may have been correct, but certainly did not apply to his traps. For, on making an exploration of his barn, machine sheds, smithy and other places, an odd trap was found here and there, covered with oil, grease, fowl manure, and all kinds of filth. After industrious investigation of a heap of nondescript looking old scrap, containing parts of broken machinery, old vehicles, various portions of the anatomy of a defunct "Lizzie," and other contraptions of a similar nature, obviously used as a fowl perch, several objects which had once been dog traps were found. Continuous throwing about, and piling of scrap iron (not to mention the "Liz.") on top of them had reduced these to a sorry looking collection. One could hardly help wondering whether he fully deserved the reputation he had acquired. If the unfortunate sheep which were lying dead in his paddock could have sized up the situtation, they would also have wondered.

It was pointed out that these traps, properly cared for and used in the correct manner, could easily have saved him a lot of money. On his own showing he had lost several hundreds of pounds worth of sheep through dogs during the past few years.

It is also necessary to guard against the deterioration of the traps resulting say, from rust or damage from being set in salty country. A personal experience illustrates the need for this. On one occasion it was found that poor trapping results were being obtained in a certain district. The settlers were interested; some had traps of their own, and the Road Board supplied others and freely loaned them to settlers. Despite the interest taken the traps failed to catch the dogs. The district referred to was chiefly lake country, and the salt nature of the ground in which trapping operations had been carried out had had a very disastrous effect on the springs of the traps. The settlers evidently did not realise this, and were continuously re-setting traps which were in a very bad condition. A number of traps were examined and found to be in such weakened condition that the springs could easily be depressed between the fingers and thumb. In fact, some were so bad that there was not sufficient strength left in the springs to lift the weight of the trap itself by a stick which had been used to spring the trap. One can easily imagine the disastrous effect of the use of these traps, which would barely hold a rabbit, much less a powerful dog, and readily understand why this district is still cursed with mutilated and cunning dogs. It is essential, therefore, that all traps be tested from time to time, particularly in salty country, before being set.

Many people set their traps and leave them set for an indefinite period. Many of these are set off by rabbits, etc., and are left exposed for dogs to see (which is a very bad fault), and also at the mercy of the elements and passers by, who often "remove" them. Some are left so long the owner even forgets where he set them, and when they are needed cannot be found. When dogs are about, the place for the traps is set in likely spots to do their work. When not in use, they should be cleaned, the poison removed, the loops drawn back to leave as little tension on the springs as possible, and carefully stacked away, or better still, hung up in a shed. Traps treated in this manner will last for years, and are always at hand when wanted. The writer has several traps which have been used for a number of years, and although they have caught many dogs they are still efficient.

When using strychnine, remember it is a deadly poison; therefore it is necessary to take every care. Many people are afraid of it, but providing reasonable precautions are taken, there is no danger to the user. Strychnine is essentially an internal, or stomach poison, and therefore will not harm the hands or skin, but after using strychnine it is always advisable to wash the hands well, to avoid the possibility of conveying it to the mouth. Take care to keep it in a safe place. When a strychnine bottle is emptied, it should be smashed and the cork destroyed. By doing this, there is no chance of others, particularly children, using it. If at any time strychnine in tins or other vessels is used, it is always a wise plan to punch holes in, or otherwise dertroy them, when finished with, for the same reason. There is little more to add, but to again state that the poison and the trap are the most effective weapons which can be employed against the dog and fox; therefore, they must be treated with the respect and consideration they deserve.

PICA AND THE EVOLUTION OF A STOCK LICK.

Geo. L. Sutton,
Director of Agriculture.

[*By courtesy of the Australian Broadcasting Commission. Prepared from Broadcast given on the 17th November,* 1933.]

As it is quite possible that some of those listening in may not be familiar with the word "Pica," and its meaning, it will not be out of place, in the first instance, to say something about it. The word is used medically, ecclesiastically, and industrially, and in each sense its meaning its different. The title of this broadcast implies its association with the health of stock, and therefore, in this instance, it is used in the medical sense, and means a depraved appetite that impels the animal to eat decomposing or other matter which it would otherwise shun.

A much more impressive synonym is ehthonophagia. This, however, is more difficult to spell and remember and is readily discarded in favour of the short Pica. Pica is sometimes pronounced Peeka, and, as this had an appeal because of its pleasanter sound, authorities were consulted to learn if the pronunciation Peeka were permissible. The New Oxford dictionary gave no warrant for this and so p-i-c-a must be pronounced pie (as in magpie), kar (as in karoo)—Pi-ka.

Sometimes an animal will have a craving for only one kind of unusual material, as, for instance, cattle for bones; the pica may then be given a specific name, "Osteophagia," which means a craving for bones, or "Sarcophagia" applied to sheep when they have an unnatural craving for decomposing flesh. When the craving is not specific and therefore confined to one particular material, but is general, and the animal has an appetite for all and sundry kinds of debris, the pica is called "Allotriophagia."

And now, to link up this unnatural craving with the use of a stock lick. For the beginning of this story, it is necessary to go back over twenty years and some 5,000 miles to the veldt of South Africa, when and where Sir Arnold Theiler and his colleagues were called upon to investigate a disease known as Lamziekte. This disease was causing enormous losses amongst the veldt-reared cattle. In March of 1919 Sir Arnold Theiler, after more than eight years patient work, was able to announce definitely that the cause of this devastating disease had been discovered. The investigators found that the direct cause of this disease was a ptomaine poisoning brought about by the cattle swallowing a toxin or poison developed by an anaerobic organism on decomposing bones which, because of their pica, they licked or chewed. This organism was similar to that known as Bacillus botulinus, and so the South African stock disease could be included in the general scientific term "botulism." This was later to prove of very great economic importance to Western Australia.

The poison produced by the organism producing "botulism" is extremely deadly; how deadly it is may be imagined from the fact that, in the laboratory experiments conducted by Sir Arnold Theiler, it was found in one instance that a dose of less than half a grain, given by an injection under the skin, produced a typical case of the disease and death in a bullock weighing over 600 lbs. When given by the mouth the fatal dose required was found to be much larger, but, even under these conditions, less than 1/30th of an ounce was found to be fatal. In one experiment about 1/10th of an ounce of what was regarded as only moderately toxic material produced a typical Lamziekte in less than a week.

This poisonous material is, however, found only on decomposing material which cattle with normal appetites would shun, and, in consequence, it was only those with pica which developed the disease. Further, investigations proved—

1. That the "pica" was due to a phosphorus deficiency in the diet of the animals, *i.e.*, the pastures grazed by them; and
2. That the depraved appetite, and therefore the disease, could be cured, or rather prevented, by feeding a supplement, which would make good the phosphorus deficiency in the diet.

In the case of the experimental animals this was done successfully by giving them daily, or tri-weekly, doses of bonemeal, and from this practice was evolved the less troublesome one of placing supplies of bonemeal in suitable receptacles where the veldt-grazing cattle could "lick" or take what they required. This was stage one in the evolution of our stock lick.

And now it is opportune to transfer the story to our own State. In 1928, an owner of a property in the central Wheat Belt reported that his sheep were dying from what he considered to be Braxy-like disease. In a flock of approximately 400 sheep depastured on wheat stubble, a number were observed to be readily eating decomposed rabbit carcases dug out of a warren that had been fumigated with carbon bisulphide several months previously. Fifteen sheep died. Dr. Bennetts, the departmental Veterinary Pathologist, investigated the case and diagnosed it definitely as botulism, thus linking up the "lamziekte" of the South African veldt-grazing cattle with the deaths of the stubble-grazing sheep in Western Australia. The treatment prescribed was to destroy the carcasses and remedy the phosphorus deficiency of the stubble pasture by the addition of another food or stock lick rich in phosphates. As had been the case in South Africa for lamziekte a bonemeal lick was recommended and with equally successful results.

In South Africa the particular form of "pica" manifested by the cattle was bone chewing. Those with the appetite in a mild form chewed only sweet or bleached bones; this form was not serious as the effect of the weather had been to remove the poisonous material from the bones. The cattle with an advanced stage of pica craved and chewed bones with decomposing meat on them. It was these cattle that swallowed the poison and developed the fatal disease lamziekte. On the South African veldt, bone chewing was so feebly manifested by sheep that these animals rarely developed lamziekte. In the West Australian case referred to the sheep had passed beyond the bone chewing stage and had developed a craving for decomposing rabbit carcases. This implies an extreme phosphorus deficiency in our pastures. Hence the need for phosphatic licks is increased.

Though the treatment prescribed by Dr. Bennetts was definitely successful yet, owing to the cost of sterilized bonemeal—about £25 per ton—and in view of the results obtained in South Africa with other phosphatic supplements, it was considered unnecessarily expensive. At the time the belief was expressed that, as precipitated calcium phosphate had proved superior to bonemeal, the necessary supplement would be supplied in the future by a specially prepared and comparatively cheap precipitated calcium phosphate. Such a material is now available under the name of "Dicalcic Phosphate."

Though this was not available at that time there were two calcium phosphates on the market, the cost of which was less than that of sterilised bonemeal. These were recommended pending the time when either a precipitated calcium phosphate or a cheaper bonemeal would be available. The two calcium phosphates referred to were basic superphosphate and finely ground rock phosphate. Basic superphosphate had the advantage that it contained precipitated calcium phosphate, but its

disadvantage was that it also contained about 50 per cent. of gypsum, which, so far as is known, serves no useful purpose and must be regarded as an adulterant. Rock phosphate had the advantage that it contained a greater percentage of phosphorus than basic superphosphate, but in the South African experiments this proved less effective per unit of phosphorus than bonemeal.

Either compound could have been used separately, but with the object on the one hand of reducing the amount of adulterant in the basic superphosphate, and on the other of improving the efficiency of the rock phosphate, a mixture of the two in equal proportions was recommended. As both compounds were likely to be unpalatable to sheep and cattle, and, as the likes and dislikes of animals are matters of importance when licks are fed separately from the ration, it was necessary to mix them with something to increase their palatability. Molasses and salt were recommended for this purpose. The formula of the suggested lick was as follows:—

Basic superphosphate or ground rock phosphate ..	10 parts.
Salt	5 parts.
Molasses	2 parts.

This was stage two in the evolution of our stock lick.

This lick was placed upon the market under the name of Formula C. by the Cuming Smith-Mt. Lyell Farmers' Fertilisers, Ltd. It was sold at £7 10s. per ton and used with satisfactory results, and supplied its phosphorus at less than half the cost of that supplied by sterilised bonemeal.

In May, 1932, the same company placed upon the market a high grade "precipitated phosphate" called dicalcic phosphate, containing 37 per cent. phosphoric acid. The Cresco Fertilisers (W.A.), Ltd., also market a similar product containing 36.75 per cent. phosphoric acid. The phosphoric acid in dicalcic phosphate is considered by Sir Charles Martin to be twice as available as that in bonemeal and three times as available as that in ground rock phosphate.

The price of the commercial dicalcic phosphate is £15 1s. 6d. per ton, and with this as a base, the manufacturers—Messrs. Cuming Smith-Mt. Lyell Farmers' Fertilisers, Ltd.—at the request of the department, have prepared a commercial dicalcic phosphatic lick containing 18 per cent. phosphoric acid to replace Formula C. The cost of this F.O.B. at metropolitan works is £10 1s. 6d. per ton, or 12s. 6d. per cwt. A comparison of the relative values of this lick and the old Formula C. is interesting. Formula C. differed from the dicalcic lick in that it contained less phosphoric acid, viz., 15 per cent. compared with 18 per cent. Further, the dicalcic lick contains its phosphorus in a much more available form than in the old lick. In the old lick less than one-third was in the form of dicalcic phosphate, the balance being in the form of tricalcic phosphate, and this is considered to be only one-third as digestible as in the dicalcic form.

Having regard, therefore, to the lower percentage and lower availability of phosphoric acid in the Formula C. lick, it is calculated that with Formula C. at 8s. per cwt. it would be necessary to spend 17s. 6d. on that lick in order to obtain the same amount of useful phosphorus as can be obtained by spending 12s. 6d. on the dicalcic lick. It will thus be seen, when the comparative values of the essential constituents are considered, that the new dicalcic lick while dearer in actual price, is actually cheaper by several shillings per cwt. even when bought at the cwt. rate and not at the ton rate. Further, Formula C. contained a considerable quantity of gypsum which, though inert, was of no value to the animal, which was, therefore, better without it.

A comparison between dicalcic lick and sterilised bonemeal is also interesting. The metropolitan price of sterilised bonemeal is £24 11s. 6d. per ton, or 25s. per cwt. At this rate the cost of 18 per cent. of phosphoric acid as found in the standard dicalcic lick is 20s. 6d. Comparing this with 12s. 6d., the cost of the same amount in the dicalcic lick, it will thus be seen, that on the basis of phosphoric acid content alone, bonemeal is not nearly as economical as dicalcic lick. Seeing that the phosphorus of bonemeal is not as available as that in dicalcic phosphate, this places bonemeal at £24 11s. 6d. per ton in a still more unfavourable position when compared with dicalcic lick at £10 1s. 6d. per ton.

Compared with prepared phosphatic licks the cost of the phosphoric acid in dicalcic phosphate is low. The easiest form of comparison is based upon the cost per unit of phosphoric acid. In dicalcic phosphate a unit of phosphoric acid (P_2O_5) costs 7s. 11d. The prepared licks contain ingredients other than the constituent containing phosphoric acid. In some cases none of these will be of value to the animal. If the value of these be ignored and only the cost of bags and mixing be deducted, it is found that for nine representative licks the unit costs of phosphoric acid range from 8s. 9d. to 106s. 3d., or, in the latter case, over thirteen times the cost of the unit in dicalcic phosphate. Even when making allowance for the commercial value of all the supplementary ingredients in the prepared licks the range in unit cost is from 8s. 4d. to 70s. 11d.* This range shows that stock raisers must consider the purchase of their stock licks not as patent medicines, but in an intelligent and business way and buy them just as they buy ploughshares or superphosphate, in accordance with relative values and prices.

The necessity for this is shown by the fact that, though the Western Australian need is for a phosphatic stock lick, there are at least two commercial licks on the market which contain no phosphate at all, and several others which contain such a small amount of phosphate that it would be impossible for an animal to eat sufficient to satisfy its need for additional phosphorus. On the other hand some of the commercial stock licks contain quite satisfactory amounts of phosphate and at reasonable costs. These are a great convenience to those who have no desire to mix their own licks, but such, if practical and business-like, will shun those which, after due allowance has been made for the commercial value of all the ingredients they contain, appear to have a margin of something like £25 per ton —75 per cent. of listed price—for selling costs and profit.

Because of its quality and its cheapness dicalcic phosphate will obviously be the base of the modern phosphatic lick essential to make good the deficiency of our stubble and other dry summer pastures. The question arises, "Are any other supplements necessary with which this should be mixed?" The dicalcic phosphate is tasteless and odourless, and will, therefore, have no natural attraction for stock. To overcome this disadvantage the addition of some molasses is advisable. Further, animals feeding on dry pasture, and particularly on stubble, have a considerable need for common salt. This then should also be added. There is no evidence that, under normal conditions, any other ingredients are necessary. The standard stock lick recommended and evolved from the results of the classical work carried out in South Africa and applied to West Australian conditions is —

Commercial dicalcic phosphate	45 parts.
Stock salt	40 parts.
Molasses	5 parts.
Water	10 parts.

*The commercial value of the other ingredients were calculated from the following rates:—Salt, £3 per ton; molasses, 6s. 6d. per cwt.; meals (valued as bran), £6 per ton; potassium iodide, 16s. per lb.; sulphate of iron (com.), 15s. per cwt.; flowers of sulphur, 18s. per cwt.; epsom salts (magnesium sulphate), 15s. per cwt.; bags, 50lb. 4s. 6d., 75lb. 6s., 112lb. 7s., 180lb. 9s. per dozen.

Now, what of the other ingredients which were common to stock licks not so long ago—lime, sulphur, sulphate of iron, sulphate of magnesium or Epsom salts.

Lime was added on general principles because it is useful in building up bones. The dicalcic phosphate supplies lime combined with phosphate and in a suitable proportion. The addition of extra lime is likely to be detrimental by disturbing the lime-phosphorus balance in the animal's body.

Sulphur is a mild laxative and may be useful on that account. It was, however, added mainly because it was known that it is an important constituent of wool, and it was accordingly assumed that it would be useful to the animal for the production of wool. It is now known that free sulphur as supplied in licks cannot be used by the animal for this purpose.

Sulphate of iron is a tonic, but was included with the object of destroying stomach worms. It is no longer recognised as effective in this connection. It is, however, astringent and, in consequence, is likely to increase the constipation due to feeding on dry stubble. To correct this, magnesium sulphate or epsom salts was added. There is, therefore, no need for these if the iron be omitted, as it should be.

Finally, it is important to emphasise that the fundamental reason for using stock licks is to make up deficiencies that are known to exist in the food. In as far as they serve this purpose they are useful and advisable, but in most cases they are wasteful and may even be harmful if they supply materials which are not lacking. It is, therefore, not advisable to use, without veterinary advice, licks which contain ingredients which are not known to be required to make up deficiencies in the diet. At present there is no definite information to indicate that generally there is any deficiency in our normal pastures other than that of phosphorus, and, in consequence, the only known need at present is for a straight "phosphatic stock lick," that is, a lick containing suitable phosphates, and only such other substances, indicated above, as are required to make it palatable to stock.

THE HOME TANNING OF SHEEP AND OTHER SKINS.

H. SALT, B.Sc., A.I.C.

(*Reprinted from Departmental Bulletin in response to numerous requests.*)

1. The skins should first be made as clean as possible. Dried skins must be soaked in water for two days or more until just as soft as fresh skins.

All the fat and loose skin on the flesh side (*i.e.*, inside) must be scraped off, because the greasier the skin, the slower the penetration of the tanning liquors.

Boil a few ounces of soap with water, and when dissolved make up to about a gallon of cold water. Use the solution *cold* to wash dirt and grease from the skin and wool. A few drops of phenyle or other carbolic disinfectant is useful in the washing water. When the skin is clean enough remove all trace of soap by rinsing.

2. Dissolve 1lb. alum and ½lb. salt in two gallons of water. Dissolve 1oz. (no more) of soda in a pint of water, and add to the first solution. Stir well for five minutes.

Soak the cleaned skins in the liquor for at least one week. Thick skins and greasy skins will take several days longer. It is always best to allow plenty of time for tanning, because over-tanning is improbable, but under-tanning might easily result. If the tanning vessel is big enough, lay the skins out on the bottom, but if they must be doubled up whilst tanning, move them at least twice a day. This prevents uneven tanning.

If desired chrome alum can be used instead of ordinary alum. Chrome alum is the more expensive, but has the advantage that the tanned skin will stand much more washing, and is generally better.

FIG. 1.—A small staker.

3. When the skins are tanned through (a little cut in the neck should be the same colour right through) wash them once in cold water. Too much washing is not advisable, but the alum is best removed from the wool. Let them drain over a pole with the wool outside for a few hours till they feel thoroughly damp, but not wet. Then nail them on a board, stretching them out as flat as possible. The better the stretching in drying, the easier is the working up afterwards.

If a slight greasiness and smell does not matter in the finished rug, rub a little *soft grease* or Neatsfoot oil over the flesh side before nailing out to dry.

When quite dry leave the skins a week or two so that the tannage can mature.

FIG. 2.—A staker made from an axe head.

4. The great secret of making a soft alum leather is in working it up well after drying. For this purpose a staking tool can be made of a piece of metal (or perhaps hardwood). This is shaped as shown in Fig. 1. The edge is blunt; an old axe head with blunt edge and rounded corners will serve quite well. An axe mounted for this purpose is shown in Fig. 2. The top of the axe should be about three feet from the ground.

FIG. 3.

To soften them, the skins are pulled over this edge as shown in Fig. 3. A considerable amount of pressure can be used.

If the skins are damped on the flesh side with a little water to soften them, they will stake much easier. Very little moisture is needed for this purpose, and some preliminary softening can be given by working with the hands.

Unless the loose tissue has been scraped off well before tanning, the staking will raise the flesh side. If the loose flesh has not been removed before tanning, this can be done now by rubbing with pumice-stone, or by gently pressing the skin to a quick-moving grindstone. A better method than the former, and safer than the latter, is to throw the skin over a pole and scrape it with a round tin lid (the lid of a tobacco tin will serve, but a larger one will work the skins quicker). Scraping must be done with judgment.

The skins should now be soft, and the flesh side fairly smooth. The wool can be combed, brushed, and, as a final finish, a narrow strip can be cut all round the skin, since the edges are often difficult to soften.

When mats of this nature are washed they sometimes dry hard. A little staking will always soften them.

Points to remember:—

1. The wool on a fresh shin is more likely to be firm than the wool on a skin which has been kept some time.
2. If the wool needs washing, do it before tanning.
3. Give the skins plenty of time for tanning, and do not forget to turn them.
4. If there is a horny streak in the middle of the dry leather, the skin is not fully tanned.
5. Pliable leather is obtained by working the skins after tanning. A damp skin is easiest to soften.

BARK TANNAGE.

Tannage with bark is not very easy in rough conditions, and, on the whole, is much slower. The skins are best lightly tanned first, and then finished with stronger liquors.

All iron must be avoided, if possible, because the tannin will blacken with iron, so that, after drying the bark, it is advisable to break off any portions blackened by the iron of the axe. Break up the dry bark in small pieces, and soak for a day. The following quantities may be found very suitable (and at least one should be available in most parts of the State):—

Mallet, 1 lb.; Wattle, 1½ lbs.; Mallee, 2½ lbs.; Gimlet, 1½ lbs.; Wandoo, 2 lbs.; Jam, 5 lbs.

One gallon of water to the amount of bark given above is used for soaking, and one-third of this is added to a gallon of fresh water. The skins are allowed to lie in this weaker solution until tanned through. This can be judged by making a small cut in the thickest part of the skin, and observing whether it appears the same colour right throughout.

When this first tannage is complete add the rest of the liquor, and leave for another week. The skins can be finished off as for the alum tannage if hard, but if they have been tanned through they should be soft enough for rugs.

The quantities of bark are, of course, approximate, and must be varied according to the amount of liquor required. If several skins are to be tanned in succession, the old liquor from one lot will serve as the first liquor for the next lot, strengthening up after the cut shows an even colour. A liquor should improve with constant use up to the third or fourth time.

TO DEHAIR COWHIDE.

As numerous inquiries have been received, Mr. A. Arnold, Chief Inspector of Rabbits, has supplied the following information:—

Soak the hide in fresh water, if it is a dried one, to which a few handfuls of washing soda has been added, until the hide is quite limp and soft as a fresh hide. Remove all scraps of fat, flesh, etc., and rince once of twice.

Now put the limp hide in a solution of unslaked lime and water, in the proportion of two to four ounces of lime to the gallon. Soak for 24 hours, the hair should then come out; if not, make up a fresh liquid and soak again, when the hair will come away from the skin readily by scraping with a blunt instrument. Give the skin two or three soakings and rinsings to free it from any lime, and then spread out to dry in the shade.

Before the skin is quite dry, rub in a little mutton fat or tallow and work the skin well. It will then be soft and pliable when dry; this will make what is called "Greenhide." Omit the fat or tallow if the skin is to be tanned.

"MAKING HAY WHILE THE SUN SHINES."

General information regarding the cutting of cereal crops for hay with special reference to oaten hay.

The following broadcast talk was given from Station 6WF on 6th October, 1933, by Mr. I. Thomas, Superintendent of Wheat Farms. It was one of a series of popular educational talks on agricultural subjects and is published by courtesy of the Australian Broadcasting Commission.

Hay-making is the process of cutting edible herbage of any kind and drying it by exposure to the sun and air. During this process the moisture content is reduced from about 75 per cent. to about 10 per cent. This greatly checks fermentation, which, in the presence of sufficient moisture, soon occurs in stored vegetable matter, with the consequent evolution of heat.

The conversion of green fodders into hay has been practised for centuries, and may have been the first great step in changing the nomad herdsman of ancient times to the settled farmer stockman.

Hay forms the greater portion of the artificial foodstuffs fed to the larger animals which perform labour and produce food for man. It is also fed to other stock to supplement natural pastures, in this State during the late Summer and Autumn months.

When fed to working horses or other stable-fed animals it is usually chaffed. The chaffing process does not increase the nutritive value, but makes it more convenient to handle and transport, and prevents waste in feeding.

During hay-making the most important change is the loss of moisture, which naturally varies considerably with the nature of the crop, and also with the stage of maturity when cut.

The value of any fodder is determined by the amount of digestible nutrients that it contains. In the case of hay this is largely dependent on the type of crop from which it is made. The choice of crops to be used for hay purposes is

determined mainly by the prevailing growing conditions. For instance, in England, nearly all hay is made from meadow grasses. On the other hand, in the wheat growing districts of Western Australia, practically the only source of hay is one or other of the cereals. Only in our more favoured rainfall districts is it possible to grow commercial hay crops of lucerne, clovers or grasses. Fortunately, the climatic conditions are admirably suited for the growth of one or other of the cereals—wheat, oats, barley and rye. Rye is not satisfactory because of its relatively low nutritive value for hay and is little grown in this State; barley gives hay of good feeding quality but is not favoured because of its objectionable awned ears. Wheat and oats, however, produce excellent hay and are extensively grown for that purpose.

The making of hay is an art which can only be acquired with practice, but there are certain general principles to be borne in mind. The object is to secure a fodder of the highest nutritive value and in this connection the time of cutting the crop is of the utmost importance. When seed formation begins the most valuable nutrients are rapidly transferred from the lower portions of the plant to the developing seed, and the nutritive value of the stems and leaves decreases correspondingly, until, when the stage of complete ripeness is reached, they are to all intents and purposes simply straw of very low feeding value. It follows, therefore, that if the best quality is to be obtained, the crop must be cut at a stage when the nutriment is more or less evenly distributed over the full length of the plant.

The greatest weight of material is obtained if the plant is cut when the grain is full-sized, but still in the dough stage. At this stage of growth, however, the lower parts of the plant have started to dry off and have become less digestible. At the flowering stage the nutriment is distributed over the full length of the plant and little change in the digestibility takes place until the grain is almost full-sized, but still in the milky stage. It is after this that the nutrients begin to leave the lower parts of the plant and go to form grain. With the development of the grain there is a decrease also in the digestibility of the nutrients and the rate of decrease becomes greater as the plant nears maturity. Therefore, the best quality hay of optimum weight is obtained after the plant has flowered and the grain is in the milky stage and almost full-sized. When cut and properly cured at this stage the hay will be of a bright green colour of good aroma, retaining the leaves and other small parts of the plant, and free from dust or mould.

Experiments have shown that carefully dried young plants are equal in value to the fresh article but in actual hay-making there is always some loss of nutritive value. Exposure to the sun reduces the palatability by bleaching and causes a loss of aromatic compounds; dew works injury and rain carries away the more soluble portions. An experiment showed that hay exposed for thirteen days to alternate wet and dry weather lost more than 25 per cent. of its original nutritive value.

After cutting the crop a certain amount of fermentation takes place, but this is soon arrested by the drying action of the sun and wind. When the partially dried material is collected in stacks or barns the processes of fermentation recommence. If the hay contains an excess of moisture fermentation is favoured and the temperature rises. Under very favourable conditions for fermentation the actual ignition point of hay may be reached and a smouldering combustion may result.

It is obvious that the likelihood of fire can be prevented by thoroughly drying the hay before stacking. This is not altogether satisfactory for if over-dried it does not ferment sufficiently to develop the aroma, flavour and colour desirable in good hay.

Following upon the cutting of the crop the sheaves should be stooked without delay. Exposure to rain results in soluble food ingredients being washed out and the sun dries out the essential oils and other volatile compounds. To minimise these losses by protecting the sheaves from the action of the sun and wind a number are placed or stood together in well-made stooks. Comparatively long open stooks are preferable for moist districts and large round ones for dry districts.

If heavy rain is experienced between the time of cutting and stacking, the stooks should be inspected. If it is found that the rain has penetrated into the stook, the sheaves should be disturbed to allow of free circulation of air. It may be necessary to dismantle the stooks entirely and so let the sheaves dry somewhat before re-stooking. Unless this is done musty and mouldy hay will result. At the same time restooking should be delayed only long enough for the excess dampness to dry out, otherwise the quality of the hay will rapidly decrease because of bleaching. It is desirable to emphasise the importance of this attention after rain, because much sickness and loss is caused by feeding musty or mouldy hay to stock.

The hay is allowed to remain in the stooks until it is sufficiently dry so that, when placed in the stack, it will not heat or mould. This stage may be determined by drawing a handful of stalks from the middle of the stook and examining the knots or joints. If these are dry, and the material when twisted in the hands breaks freely, it can be stacked without danger. When this point has been reached, the hay should be stacked as quickly as possible, otherwise it will deteriorate in quality.

At the end of each day, during the time the hay is being stacked, it is as well to adopt the practice of pushing the long handle of a pitch fork well into the centre, but towards the bottom of the stack, and let it remain there over-night. Should it not be unduly hot the following morning, the stacking can be continued with confidence.

Once the stack has settled down, the hay undergoes little further change, retaining its attractive appearance and aroma over very long periods. Gradually, however, the aroma disappears, the hay becomes britte, dusty and less palatable and can then only be used satisfactorily along with other fodder.

Wheat crops affected with the disease Flagsmut should not be cut for hay as this is a certain means of spreading the disease. The same applies to crops infested with Wild Turnip, Wild Radish and other noxious weeds.

The fact that the inclusion of oats in the cropping system of the wheat farm is necessary in connection with the control of the wheat diseases, Take-all and Flag Smut, which are taking such a large toll of our wheat yields each year, makes it essential that larger areas of this crop should be planted. Unfortunately, the resulting grain crop is not normally as remunerative as wheat. It is, therefore, usually more profitable to harvest the crop for hay. Some farmers, however, are reluctant to do this, because they are not aware that oaten hay is equal to wheaten hay when both have been cut at the correct stage and properly cured.

The chief cause of trouble in feeding is that in many cases oaten hay is not cut until the crop has reached the stage when the grain is full-sized and in, or past, the dough stage. It is claimed by those who practise this late cutting that if the crop is cut earlier, horses will not eat it readily, but this is not in accordance with experience. In one case, an advocate of late cutting severely criticised the cutting of a crop considered to be too green, but later the same person favourably commented on hay made from this crop when cut into chaff and used by him to feed his own horses.

Another objection raised to growing oats for hay is that they grow too rank and coarse. Under normal climatic conditions it will usually be found that such

crops have been planted before the main grain crop. This practice is followed so that the hay may be cut and stacked before the harvesting of the grain commences. With late maturing varieties, as "Algerian," such a practice was essential, but with the more recently introduced early maturing varieties, such as "Burt's Early" and "Mulga," this practice in most districts is not now necessary. The most satisfactory stand is obtained when the seed is planted in accordance with the Departmental seeding calendar advocated for the different maturing varieties in the district in which the farm is located. As most farmers are more familiar with the maturity of wheat varieties, the following will act as a guide for the planting of oats—the late maturing variety "Algerian" would be planted during the period recommended for the late maturing varieties of wheat—"Yandilla King" or "Sutton"; "Guyra" oats a mid-season variety, the same time as "Nabawa," while "Burt's Early" or "Mulga," early maturing varieties would be planted the same time as "Gluyas Early" wheat. Greater or lesser bulk of material can be expected when the seed is sown earlier or later.

It should be the aim of every farmer to produce hay of the best quality, and this can only be done if the various processes involved are properly understood. In conclusion, therefore, I would emphasise that to obtain this high-quality hay it is important that—

1. The crop intended for hay be planted during the period most suitable for the maturity of the variety grown;
2. It be cut shortly after the plants have flowered and when the grain is in the milky stage and almost full-sized;
3. The sheaves be stooked immediately after the crop is cut;
4. The stooks receive attention after rain; and
5. The hay be stacked without delay after the material has sufficiently dried.

FIRE CONTROL ON THE FARM.

By A. C. Shedley, B.Sc., Dip. For.

The following was given as a broadcast talk through Station 6WF and is published by the courtesy of the Australian Broadcasting Commission.

The term "bush fire" is applied by Australians indiscriminately to all fires which burn grass, hay, stubble, scrub, or forest. In many parts of Australia there are regions of wide extent and small population, where bush fires are a regular occurrence each summer. They may burn for weeks on end without exciting any interest or comment, despite the fact that such regions include areas of valuable forest. On the other hand many so called "bush fires" are confined to other farming or pastoral country and although not the direct concern of the forester, may eventually become so if they are likely to encroach on to forest country.

In a country such as Australia, extending from a tropical North to a temperate South, and including high mountain regions, there are many varied soil and forest types, and among the 300 different Eucalypts and other tree species are to be found associated with them very many vegetative types. This vegetation may vary from grass in the open woodlands, through woody scrub in the drier forest areas to dense green vegetation in the wetter areas. In W.A. the scrub over the majority

of the State is of a woody nature, while small areas of grass country are occasionally met with, as, *e.g.*, in the Tuart forest along the coastal limestone belt, while in the Karri country the more succulent vegetation is common.

Grass country will burn every year, the dry scrub of the Jarrah belt only once in every two or three years, and the scrub in the moister areas perhaps only once in five or six years. This means that there is a greater accumulation of debris which causes very dangerous bush fires in some parts of Australia, notably Victoria, during certain days of high wind and low humidity. There is evidence that fires occurred in many forest types before the first white settlers arrived in Australia, but as a general rule the floor of the virgin forest carried a less severe fire and the blackfellow showed considerable discrimination in his use of the firestick.

Among the most remarkable characteristics of the Australian "bush" is the manner in which the mantle of green foliage is quickly replaced even after a severe crown fire and effectively hides all damage from the casual observer. Some Eucalypts, however, are killed outright by a severe bush fire.

Fires have been put through forest areas by stock-owners all over Australia to improve their grazing value by burning off the old grass and inducing young shoots from the hard woody scrub, and similar burning occurs to-day in the South of France.

It is maintained by many people with some show of altruism that it is better to get the forest alight as frequently as it will burn, rather than protect it for many years, in order that debris may be allowed to accumulate and then catch alight with disastrous consequence to the whole countryside.

Stringent fire-laws are a necessary foundation for both fire prevention and fire suppression. Southern Australia is a land of long dry summers, and the recognised necessity for careful protection of cereals and pastures in early summer is clearly shown in the various Acts for the prevention of bush fires. The Bush Fires Act, of 1902, W.A., makes provision for prohibited times during which it shall be declared unlawful to set fire in the open. This prohibited period is fixed by *Gazette* notice, on the recommendation of the various Road Boards, and although it may vary slightly from district to district, it usually takes effect from November, which is before the summer fire hazard commences, and extends to the middle of February, which is the hottest period.

No person, however, shall burn any part of the bush—which means grass, stubble, scrub, bushes, trees and all other vegetation, at any time during the months of October to April, both inclusive, unless—

(a) he has delivered or caused to be delivered personally to each owner or occupier of all adjoining lands, four clear days' notice in writing of such intention:

(b) he keeps at least three men in attendance until all grass, stubble or scrub has been burnt, to prevent such fire extending beyond the limit of his own land or land occupied by him.

Subject to these two conditions and during such prohibited times any owner or occupier of land may burn off the bush between two plough breaks or spade breaks, between the hours of 8 o'clock in the evening and 12 o'clock midnight, for the purpose only of protecting any dwelling house or other building or stack of hay, wheat or other produce within ten chains of a dwelling house or other building.

Provided also that the outer break shall not be distant more than ten chains from the property to be protected.

There is another section which is of more interest to the general public, and it provides that a person lighting or using any fire in the open air for the purpose of cooking or camping shall clear a space of ground of a radius of ten feet at least, and shall completely extinguish the fire before leaving the place.
To make these points clear—

1. During the prohibited period as gazetted for each Road Board, usually from November to February, no burning can be undertaken except restricted firebreak burning by night to protect buildings, hay, wheat, etc., under conditions set out.

2. From the end of the close season, usually some time in February, burning can only be carried out until the end of April, provided notice is given to adjoining occupiers and three men are kept in attendance.

3. From 1st May until the end of September there are no restrictions about burning off.

4. From 1st of October until the closing of the fire season, usually some time in November, burning is permissible provided notice is given to adjoining occupiers and three men are kept in attendance.

5. At all times during the year a space of ground of a radius of 10 feet at least must be cleared before a person lights a fire in the open for cooking or camping.

The amendments of the Bush Fires Act, in 1925, made provision, *inter alia*, for any defined portion of the State to be declared a fire protected area, and within such gazetted area it is necessary for a settler to obtain a permit before carrying out any burning operations at any time of the year. The only areas so declared at the present time are those within a certain radius of Collie and Mundaring Weir, where fire towers have been erected for the detection of fires, and in those districts the Forester issuing the permits is enabled to investigate the area before burning is carried out, choose the time and weather conditions suitable to the particular locality, and satisfy himself that the landholder is prepared to take the precautions necessary.

Under the Forests Act of 1919—

> Any person who sets fire in the open air to any tree, wood, bush or grass, on any land contiguous to a State Forest or timber reserve, without giving notice of his intention to a forest officer so as to allow such officer to be present at the firing, commits a forest offence.

In the development of a country, fires play an important part in the clearing operations, and in burning off the woody scrub to provide a certain amount of rough grazing. It has been suggested that after the summer there should be two periods for burning off, one for the burning after clearing and the other for burning scrub, stubble and grass, at a later date. The cleared areas are usually confined to comparatively small areas, the fire quickly passes over them, and if proper precautions are taken there is little risk of the fire escaping. This early burn would provide the maximum of time for the clearing up of the area before the winter months.

The burning of scrub, stubble, and grass, which is often carried out over extensive areas without any attempt being made to confine the fire to a definite area could well be left until a later date when on account of the cooler weather conditions control would be much easier.

The limiting of these clearing fires is more important at least in the South West, than for scrub or grass fires, because of their greater severity, and, owing to the fact that the areas are relatively small and intensively worked, this can

usually be accomplished by taking simple precautions including the prior construction of firebreaks.

In the Wheat Belt the outbreaks of uncontrolled fires which sweep the country are largely accidental and are mainly caused by stationary or traction engines or more rarely by burning off.

The problem is to a great extent solved by the cutting of hay on strips around the boundaries of paddocks, followed by the ploughing of breaks, before the main crop is ready for harvesting, by burning out during the winter months of the dense scrub growing in the low lying areas; and by co-operative effort in extinguishing an outbreak when it occurs. There is, however, need for organised effort in this regard, and information concerning the practice in other States and the formation of fire fighting associations to cope with bush fires will be given in the next article.

Where sheep is combined with wheat farming, the conservation of feed and the protection of it from fire during the summer months are just as important, although perhaps not so difficult of accomplishment because of the more thorough clearing methods adopted, and to the fact that owing to the absence of scrub the uncleared forest country does not burn so readily as it does in the South West.

In the South-West of the State the uncontrolled fires which devastate the country arise chiefly from the burning off operations either directly, or indirectly, by people burning back from their boundary towards fires in the vicinity. The opening of the close season is always marked by the numerous smokes which arise from burning off operations which make observation from Forest Department lookouts and location of fires a very difficult matter.

There are, of course, in addition, fires lighted by irresponsible or ill balanced persons who are apparently governed by a desire to see the bush burn.

In the South West, control of fires is more difficult especially on account of the early stage of development of most holdings. Owing to the high cost of burning up the heavy stand of timber which is found on nearly all properties in the South West, clearing for pastures is not so thorough as for cultivated crops, and is usually carried out by grubbing the smaller and ringbarking the larger trees. These ringbarked trees for many years are a constant fire menace, owing to their inflammability, and the ease with which the tops will light up from small pieces of burning bark or decayed wood blown from adjoining trees. It is important then to see that these ringbarked trees do not get alight during the hottest parts of the summer, and the danger can often be eliminated by the provision of protective belts of green timber which can be burnt in early summer or by burning early a strip of grass country between two ploughed strips surrounding paddocks to be protected.

These belts of green trees burnt in early summer before there is much chance of a fire escaping, can be placed over the property so as to break up the hazards, they can often be selected on account of their unsuitability for growing heavy pasture crops and yet provide a certain amount of rough grazing and shelter for stock. The burning of scrub associated with jarrah trees will often be easier to control in the autumn, during the months of April and May, when the leaf litter which has accumulated on the ground during the summer months from the falling of the leaves from the native trees will assist in carrying the fire and making a much clearer burn. The dewy nights will also assist in damping the fires which will frequently go out at night if started during the afternoon.

Too often no attempt is made on the wheat belt or the South West to isolate new clearings which are to be burnt later in the summer or to consider the clearing in relation to other areas, the burning of which would result in the escape of the fire from control.

By studying the direction of the wind, and selecting suitable weather conditions, providing protective belts as mentioned previously and taking the necessary precautions to have men in attendance as provided by the Act, chopping down ringbarked trees if they are too near and likely to prove dangerous, and raking around any green tree which is likely to carry the fire up its flakey bark or catch alight on the top from some lighted material being drawn up by the rising of the hot air, the burning off operations become a simple matter, without serious risk of the fire getting away. This is evidenced by the considerable amount of controlled burning which is annually carried out by the Forests Department on fire belts surrounding treated compartments and adjoining private property, and over country which is not carrying re-growth or would not suffer from a light burn put through when conditions are not severe.

The practice of the Department in burning the country in advance of felling operations of the mills or sleeper cutters and then burning up the tops of the trees which have been felled, has resulted in the saving of much valuable immature timber, and in preventing the starting of fires in such highly inflammable material during the summer months.

This control of burning operations has relieved many farmers, whose properties adjoin State Forest, of the constant fear of bush fires coming in from open country on to their properties.

It is hoped that arrangements will be made to broadcast during the coming summer, information about the approach of "blow up" days, *i.e.*, days of high temperatures accompanied by strong dry winds, when any small fire is a potential raging bush fire, almost impossible to control and liable to do untold damage.

These days most frequently occur in January and February, but even in March, after the opening of the fire season, there are days when burning off is attended with too much risk, and the information broadcasted should be of material assistance to the farmer in avoiding such days for lighting fires.

POTATO GRADING.

E. T. Morgan, Officer-in-Charge, Potato Branch.

The grading of potatoes has received more attention since 1930 than at any previous time in the history of the potato industry of this State. The primary cause of this interest was the regulations under the "Agricultural Products Act, 1929," dealing with potatoes and gazetted in 1930. After two years working it was found necessary to have alteration made in the grading regulations, and in August of this year (1933) a new set of regulations was authorised and published in the "Government Gazette" of 11th August, 1933.

The said regulations state that—

14. (1) Potatoes grown in Western Australia and intended for sale either in the State of Western Australia or in any other State of the Commonwealth of Australia shall be graded according to the following grades, namely:—

(a) Grade 1.
(b) Grade 2.
(c) New Potatoes.
(d) Seed Potatoes.
(e) Stock Food.

(2) For the purpose of grading potatoes according to the said grades:—

"Grade 1" shall mean sound potatoes, not necessarily of one variety but of similar varietal characteristics, weighing not less than 3ozs. each, mature and free from dirt or other foreign matter, second growth, digging injury, damage caused by disease, sunburn, insects, or greening from exposure.

"Grade 2" shall mean potatoes of similar varietal characteristics, weighing not less than 3ozs., and free from wet or dry rots, dirt or other foreign matter. The term includes potatoes in which a light infection of common scab, second growth, black spot, insect injury or other skin blemish occurs, if the damage resulting from the said causes can be removed by the ordinary process of paring without appreciable increase in waste over that which would occur if the potato were perfect.

"New Potatoes" shall mean potatoes which comply with the standard of Grade 1 in all respects other than weight and maturity of skin. They shall not have a mature skin, but shall weigh not less than 2ozs. each in all calendar months other than July, August, and September, during which months they shall weigh not less than 1¼ozs. each.

"Seed Potatoes" shall mean sound potatoes intended for planting and which are of one variety, weighing not less than 1¼ozs., and shall be free from dirt or other foreign matter, digging injury, or damage caused by disease, sunburn or insects.

"Stock Food" shall mean potatoes intended for stock food and not for human consumption.

Provided that potatoes contained in any one parcel of potatoes shall be deemed to comply with the standard of a grade, if at least ninety-five per centum thereof by weight comply with that standard.

15. Potatoes intended for sale for human consumption or for seed shall, for the purpose of transport, be packed in new or clean second-hand bags of good quality, or in other containers approved by the Department of Agriculture. Bags which have contained organic manures or any other deleterious or obnoxious substance shall not be used as containers for such potatoes.

16. The bags or other containers in which potatoes intended for sale are packed shall have legibly marked on the outside thereof and in a conspicuous place the name and address of the grower, followed by the word "Potatoes" and the grade thereof.

The importance of properly grading potatoes before sending them to market cannot be too strongly emphasised, and it behoves every grower to exercise keen scrutiny to insure that his product complies with the standard laid down prior to marketing.

The place to grade potatoes is on the farm, and they must be graded before consigning forward; if the seller does not do it, he usually has to pay someone else a big price for doing it.

The realisation that he pays for this service, and that such service is infinitely more expensive in the city than on the farm is rapidly converting the grower to the better policy of home grading.

Well graded stock will always take priority of sale over ordinary stock, whilst ungraded stock usually sells on the basis of the poorest material in the bag, rather than on its average quality.

The greatest cause of failure of potatoes to comply with a given grade is the amount of fork-injured tubers placed in the bag. The system of piece-work digging carried out in many portions of the State renders it extremely difficult of control, and it is only by the strictest supervision of the grower or man in charge that the trouble can be obviated. The majority of the potatoes in this State are still dug with a fork, and this method of harvesting undoubtedly injures many tubers.

Machines have been used on a small scale for a number of years, and where conditions are right the work is performed more satisfactorily and cheaply. If the land has been well cultivated and is free from stumps and stones, the machines will do excellent work. The accompanying photograph was taken on the property of Messrs. Coley and Sons, Marybrook, Busselton, and shows a 12-ton crop of tubers being dug with a mechanical digger, the injury to tubers being practically nil.

The potato digging plough has been in use spasmodically for many years, and is quite satisfactory. Messrs. Packer and Hersey of Cannington, use this implement each year, and two years ago a 16-ton crop per acre was successfully handled by this means. A count taken of mechanical injury showed five cut potatoes in 200 or $2\frac{1}{2}$ per cent., a percentage very much lower than would be obtained by fork digging.

Digging potatoes by hand is slow, expensive work, and it is poor economy to do without a potato digger. Remember, human labour is the most expensive item the grower has at digging time. He cannot afford manual labour when a machine will do the work.

PRICES AND COST OF PRODUCTION.

A. C. Jenyns, Poultry Adviser.

Many poultrymen to-day are in doubt whether to carry on in face of the lower prices offering. This question causes one to turn to the methods adopted on the farm. The reasons why some are not making things pay are obvious. It is only those who realise that poultry farming is a business that requires business methods of as keen a nature as any shop or workroom in existence to-day who will make it a success.

The day of ragtime methods is gone; production has reached a stage when only the best quality in egg and hen will show a profit. Not only must the aim be more eggs per hen, but that hen must be bred and kept on lines that will give longer service, or at least another year of profitable laying. Production costs must also be lowered to meet the lower prices. This does not only mean looking for cheaper foodstuffs, building materials, etc., but to the things which are in the farmer's own hands, on the farm; here is where the greatest *immediate* effect can be shown. Some of the most outstanding features in this lowering of production costs are the most neglected by the producer on his own farm.

GREEN FEED.

This is where a large amount of cost can be reduced. The average farm to-day no matter whether large or small, grows barely sufficient green-feed for one-third of the birds carried. Supply the difference and see the drop in the feed bill: it will be a surprise to many. Too few poultrymen appear to realise the value of green-feed. It should comprise at least from 50 to 70 per cent. of the daily feed, this will not only lower the feed bill, but it lowers the bill of disappointment and loss caused by disease. There would be little need for dosing up the flock at frequent intervals with all kinds of unnecessary preparations if sufficient greens were used. Also the egg would be richer, of better quality, and more enticing to the public, who after all, must in every possible way be induced to realise that a good egg *can* be obtained, not only good in appearance, but in food value.

What a difference it makes to the appearance of efficiency on a farm to see plenty of lucerne, maize, etc., growing, instead of the usual sand patch and sickly stock.

CULLING.

Too many flocks are carrying as many as 30 or 40 per cent. duds, birds which either never have or will show a profit, or birds that have long ago past their day of profitable return. If these were culled out and the value of the food consumed added to the monthly credit, it would in many cases turn loss into profit.

Imagine a farm with 800 or 900 head of stock, 200 of which need culling out. These 200 are eating their two or three ounces of food per day, and giving nothing in return. Cull them out, and the same egg return remains; add the cost of their food to the credit side and see the difference. Start this culling in the incubator and follow it right through every stage of the bird's life. The result will be that only the profitable stock will be brought to the laying sheds. This culling has been done on many farms and the benefits have been so marked it is hard to credit how few farmers are believers in hard culling all the while.

LEG WEAKNESS.

Lack of Calcium.

In regard to leg weakness we hear so much about, cases are brought under notice day after day, and though there are several causes of birds losing the use of their legs, it is found in Western Australia the main cause is lack of calcium. Poultry farmers do not seem to realise that shell grit alone will not supply sufficient of this mineral. Bone meal *must* be used, at the minimum rate of 2½ per cent. daily.

In the majority of cases of leg weakness brought under notice, bone meal has been entirely lacking in the ration. On adding it the trouble has disappeared in a few days. This lack of calcium also has a vital effect on the egg, especially in respect to the shell. Much loss is sustained by growers during the egg export season through weak shells and cracks. It is astonishing how few understand what is needed by a hen to produce an egg of good quality in every way. Where bone meal is fed and increased as the egg yield increases, the shells are kept firm and strong. On the other hand, where no allowance is made for the increased supply of calcium needed, the shells become weaker and thinner, giving more rejects and breakages, and in many cases a large quantity of soft-shelled eggs entirely unfit for market.

These are a few ways in which the cost of production can be reduced and many of the losses on the farm avoided. If poultrymen would turn their minds from higher prices to better management, to bringing costs lower to meet the lower prices, to buying less and making more of their own efforts, and a realisation that in these times it is only by eliminating waste of both material and energy on the farm itself that success can be found, there would be more profitable farms. Prices are governed by that law of supply and demand, and the only way to increase that demand is by giving the public what they demand, "A good article."

Some producers are doing this, but it is the many who adopt careless methods, who are the cause of low prices and low consumption.

Breeding, feeding and general management must be adjusted to meet the existing conditions.

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PIGS FOR EXPORT.

W. G. Burges, "Tipperary," Burges Siding.

Geo. L. Sutton, Director of Agriculture.

G. K. Baron-Hay, Superintendent of Dairying.

PRELIMINARY REPORT OF EXPERIMENTS CONDUCTED AT "TIPPERARY," 1932-33.

With the object of providing for the standardisation of porker and bacon pigs to meet the requirements of the local market, a conference of the bacon manufacturers and leading breeders was called early in 1930. The unanimous recommendation of this conference was that the pig best adapted to meet the requirements of the local market for porkers and baconers was the progeny of a Berkshire-Tamworth sow by a Berkshire boar. At the same time it was thought that this cross would also be suitable for the export trade. The development of the pig industry, however, was so rapid that in 1931 it became necessary to find an outlet for our surplus pigs by exporting them to Great Britain and, with a view to ascertaining the type required, a consignment of Tamworth-Berkshire cross pigs was sent from the Muresk Agricultural College and the Denmark Experiment Farm. The reports from London indicated that, although no fault could be found with the quality of the consignment, in every case the covering of fat on the back was too thick.

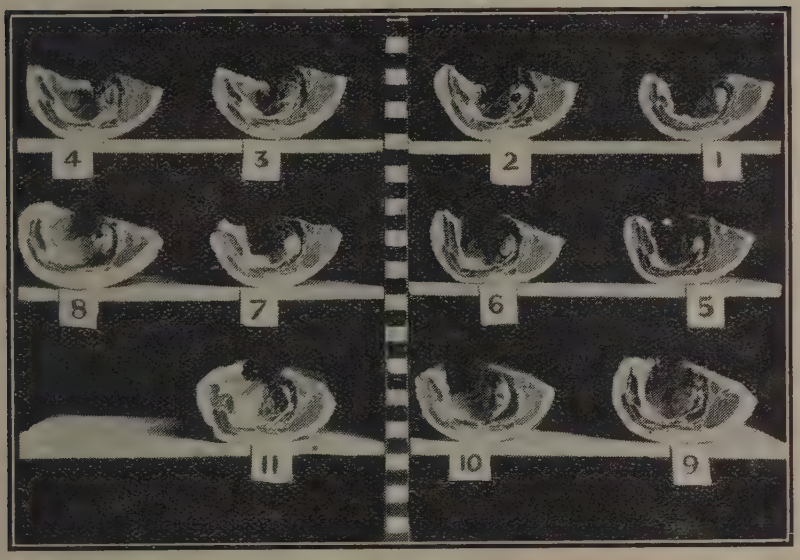
Bearing in mind the very strong recommendation of the Empire Marketing Board for the utilisation of the Large White breed in catering for the British trade, it was decided to carry out experiments in which crossbred pigs produced by mating Berkshire sows with Large White and Tamworth boars would be compared with each other with regard to the suitability of their carcases for the British market.

The experiments were carried out at the Tipperary piggery, which, with its herd, was generously placed at the disposal of the department by one of the authors, who also imported a Large White boar specially for the trials. In June and July, 1932, the first series of experiments was commenced when Large White and Tamworth boars were mated—each to three pure bred Berkshire sows. The first sow farrowed on October 6 and the last on November 23.

DETAILS OF FEEDING.

All litters received the same kind of food, and the sows were confined to the sty for the first three weeks after farrowing, but afterwards were kept in small fields which are sown to cereals for grazing during autumn, winter, and early spring, the litters remaining with the sows and having access to the same feed in the troughs. Litters were weaned at ten weeks. Until then the sows received a daily ration of two gallons of milk and three lbs. of meal. The unweaned pigs also received meal in addition to their mother's milk—as much as they would clean up readily.

The standard daily ration fed to the weaned pigs was milk at the rate of half a gallon per day when available and, in addition, meal in amounts appropriate to the age of the pigs. The meal consisted of ground wheat to which five per cent. meatmeal was added. If the milk available was less than half a gallon per day, the



New Zealand carcases showing thin layer of fat desired by the British market.

12 LARGE YORKSHIRE BERKSHIRE 169
13 LARGE YORKSHIRE BERKSHIRE 185
15 PURE BRED TAMWORTH 155
18 LARGE WHITE BERKSHIRE 150
17 LARGE YORKSHIRE BERKSHIRE 179
20 LARGE WHITE BERKSHIRE 153
21 TAMWORTH BERKSHIRE 125

West Australian carcases much too fat for the British market

amount of meatmeal was increased so as to supply the amount of protein previously supplied by the milk. When the pigs in the first litter were almost six weeks old they, and the progeny of the other four sows which had farrowed, were weighed, and the weighings were repeated at intervals of approximately four weeks.

In December, 1932, and January, 1933, a second series of experiments was commenced, when the Tamworth boar was mated with two and the Large White boar with three Berkshire sows. As the pigs reached suitable weights they were consigned for treatment to Messrs. Watson & Sons and Foggit, Jones, Limited., who went to considerable trouble to assist in the work, and who later forwarded them to Messrs. Sheed, Thomson & Co., Limited, London, for sale and report. This firm was very interested in the trials, and not only furnished a special report on the carcases, but also obtained an additional one from Mr. J. B. Swain, of the Empire Pork House.

The report on the first consignment was to the effect that the carcases were the best that had been received from Western Australia, but they were altogether too fat. In the second consignment, carcases of pure Large White and pure Tamworth pigs were included. The reports regarding these were not altogether favourable, the most satisfactory carcases being the Tamworth. In reporting on these pigs Mr. Thomson, of Messrs. Sheed, Thomson & Co., Limited, considered that, as the pigs were bred along the lines recommended and being followed in New Zealand, it must be the feeding that is at fault. Although the way in which these pigs had thriven was very satisfactory, it is possible that some alteration in the feeding whereby they receive a greater percentage of protein than is customary, may be advisable under West Australian conditions. It, however, may be that an alteration in the type of sow used for the production of export pigs will be necessary. It is intended to investigate both these aspects in future experiments.

LESSONS ON THE TESTS.

The conclusions from the experiments up to date are as follows:—

1. Both the Large White-Berkshire and the Tamworth-Berkshire crosses produce carcases of excellent quality, but with condition too fat for the British market.

2. There was greater uniformity as regards weight in the piglets in Tamworth-Berkshire litters than in the Large White-Berkshire litters.

3. The average number per litter of piglets born was Tamworth-Berkshire 8.4 and Large White-Berkshire 8.2; the average number reared was 7.6 and 6.7 respectively.

4. Under average farm conditions the Tamworth-Berkshire cross has proved hardier and more free from disease, particularly pleurisy.

5. No evidence of scalding was noticed with the White pigs during an excessively hot period in the late summer of 1933. On the other hand, every piglet in a litter of 11 about a fortnight old, when let out of the sty for the first time on November 15 -a very cool but sunny day -scalded badly. It was found particularly difficult to keep the White pigs free from lice, and it is probable that some of the scalding to which these pigs are said to be subject, is possibly due to failure to keep them free from these vermin, and this, indirectly, causes scald as the result of rubbing.

6. During the summer months the average monthly gains of all crosses were approximately the same.

7. The Large White crosses appear to feel the cold, and during the winter months the Tamworth-Berkshire crosses make definitely greater gains.

8. Indications with the crossing of either the Large White or the Tamworth boar with the Berkshire sow are that it will be necessary to select Berkshire sows of the bacon type—*i.e.*, lengthy sows with light forequarters. It is probable that the Tamworth-Berkshire comeback would provide a more suitable carcase than the Tamworth-Berkshire first cross.

TICK AND LICE INFESTATION.

The Value of Dipping.

Hugh McCallum,
Sheep and Wool Inspector.

Now that the time has come for the annual dipping of the flock, it is felt that its importance as a method of checking the ravages of the parasites, lice and tick, must again be stressed. During the past few years the number of infested flocks has increased, as many sheep owners neglected the operation of dipping when wool prices were low.

There are three reasons why owners should dip their flocks. The first, and this alone should be sufficient to induce them to do so, is that if the flock becomes infested, the wool rapidly deteriorates in quality and this results in a direct economic loss to the grower. When opened up on the show floors where it is displayed for sale a ticky clip appears thin and ill nourished and of a dingy unattractive colour.

Secondly, if dipping is neglected the parasites quickly gain ground, and this may result in a very great loss to the State at a time when the revenue derived from the sheep and wool industry is of such vital importance to it.

Thirdly, if a grower neglects to dip his flock it must inevitably become infested and prove a menace to surrounding flocks. It is almost certain that the infestation will spread to flocks on adjoining properties, no matter how carefully neighbouring owners may guard against it.

There are a number of proved poisonous dips which are quite efficacious providing the instructions for mixing issued by the manufacturers are strictly adhered to.

The dipping should be performed on a sunny day, preferably from 4-6 weeks after shearing. If the sheep are driven long distances to the dip they should be allowed to settle down before dipping is commenced, and none should be dipped within an hour of sunset so that all may dry before nightfall. The dip must be emptied and cleaned out as often as the makers of the dip suggest, in order to avoid dip-stained wool. Each sheep should be completely immersed, and allowed sufficient time in the bath for the dip to reach the skin.

When purchasing sheep always inspect them very carefully to ensure that they are not infested with lice and tick. The pest is often introduced into a flock in this way. In fact, many farmers when purchasing sheep for the first time have, owing to their carelessness, thus introduced the pest into areas in which it had before been unknown.

Farmers may obtain bulletins dealing with this infestation of sheep from the Department of Agriculture. These also give full details regarding the construction of dips.

NITROGEN-FIXING BACTERIA FOR LEGUMINOUS PLANTS.

Pure Cultures obtainable from Plant Pathology Branch.

H. A. Pittman, B.Sc. Agr., Plant Pathologist.

INTRODUCTORY.

All green (chloropnyll-bearing) plants require, for their successful growth, certain chemical elements such as carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, magnesium, calcium and iron. These ten substances were formerly considered to be all that were required by green (chlorophyll-bearing) plants, but of recent years it has been found that certain other elements may also be required by some species in comparatively small amounts. Such additional substances are—aluminium, silicon, sodium, chlorine, manganese and boron, etc.

The elements essential for the successful growth of plants do not appear to be interchangeable or mutually substitutable to any great extent, if at all, in the physiology of the plant. Thus a soil which already contains ample potash, for example, in a form in which the plant is able to use it (that is, "available" potash) will not have its fertility (crop-producing power) increased by additional quantities of potash, if some other essential element is deficient in proportionate amount. A lot of extra flour or butter in a cake will not make up for a lack of currants or milk, and the same sort of argument applies to plant nutrition also.

Most soils contain, in available form, abundance of every chemical element required by plants with the exception of phosphorus, potash, or nitrogen. The deficiency of phosphorus is generally remedied by the use of superphosphate, blood and bone, bone dust, etc.; that of potash by sulphate or muriate of potash or Kainit; that of nitrogen by sulphate of ammonia, blood and bone, nitrate of soda etc., or by the growth of leguminous crops bearing nitrogen-fixing bacterial nodules on their roots.

The growth of leguminous crops does not, *ipso facto*, that is to say, of necessity, increase the nitrogen content of the soil, but only if the roots of the leguminous crop are infected with the appropriate nitrogen-fixing bacteria. Moreover, to obtain the full soil-improving benefit of growing such crops, they must be ploughed in or fed-off *in situ*.

When leguminous plants are infected with the nitrogen-fixing bacteria, characteristic swellings or nodules, which vary in appearance with the particular plant species concerned, will be found on the roots. In these swellings are to be found millions of tiny germs (bacteria) which enable the plant to draw freely on the inexhaustible supplies of gaseous nitrogen in the air—a feat which is quite impossible by any plant, leguminous or otherwise, in their absence.

PURE CULTURES OBTAINABLE.

Pure cultures of those nitrogen-fixing bacteria which form nodules on the roots of certain species of the family Leguminosæ, which includes such important agricultural plants as lucerne, peas, clovers, soy beans, French beans, etc., may be obtained on application to the Plant Pathologist, at the prices indicated below.

These bacteria, after forming swellings known as nodules on the roots of leguminous plants, enable the infected plants to make use of the inexhaustible supplies

of free nitrogen in the air.* Although, in the absence of such nitrogen-fixing bacteria, some legumes may make quite satisfactory growth on soils containing abundance of combined-nitrogen (in the form, for instance, of humus compounds, sulphate of ammonia, etc.), the full economic benefit of growing such plants can only be obtained when the appropriate bacteria are present.

OLD METHODS OF INOCULATION.

A common method of introducing the bacteria on to a new field, or farm, is to inoculate the new area with soil from a field which has previously grown successful crops of the kind under consideration, and on the roots of which abundant nodules have been found. This method is quite satisfactory in most cases, but has the disadvantage of sometimes introducing plant diseases, insect pests, or weed seeds. If attempted, it should be carried out preferably during dull weather or late in the afternoon, so as to minimise the harmful effect of sunlight on the bacteria. About one hundredweight (1cwt.) of infected soil should be used per acre and be well cultivated or harrowed in.

Another method of inoculation sometimes used is to dip the seeds before sowing in some sticky but harmless substance such as skim milk, thin glue, or a sugar-syrup made by dissolving cane-sugar in hot water and then cooling before use. The seeds are made sticky by the treatment, and, after being dried as much as possible by being spread out in a shady place, are rolled about in a little soil containing the bacteria. The sticky seeds take up a coating of the bacteria-infected soil and then are sown as soon as possible.

Where the crop has already been planted, an 8-ounce bottle of culture (see below) may be used to inoculate about one hundredweight of sweet, moist, fertile soil by first mixing the bacteria with water. The heap is thoroughly mixed by repeated turning and is then allowed to stand in a cool shady place for a day or so before broadcasting it over the field at the rate of about one hundredweight per acre. This method does not appear to give nearly as satisfactory results as seed inoculation, at least for annual crops.

USE OF PURE CULTURES VERY DESIRABLE.

In newly-settled areas so far remote from fields already inhabited by the desirable bacteria that the obtaining of soil is not easily, or economically, practicable, the artificial cultures will be found a great boon. They have been used in the past by many farmers in this State, and particularly in the Group Settlement areas, on newly-cleared land, with great success. They are free from weed seeds, insect pests, or organisms causing plant diseases, and in this respect are much to be preferred to the use of infected soil. By the use of infected soil or the pure cultures a good stand may be obtained during the very first year, instead of having to wait three or four years as is otherwise often the case in subterranean clover paddocks, etc.

QUANTITIES AVAILABLE, PRICES CHARGED, ETC.

The bacteria are supplied on the surface of jelly-like agar slopes in two-ounce medicine bottles, or in eight-ounce medicine bottles containing about four times the quantity of the smaller size. To cover cost of materials, glassware, wrappers, postage, etc., the following small charges are made:—

(a) Two-ounce size—1s. 6d.

(b) Eight-ounce medicine bottle size (containing 4 times the quantity in (a))—2s. 6d.

*The average composition of normal air by volume may be taken as follows:—Nitrogen 76.96 per cent.; oxygen 20.65 per cent.; water vapour 1.4 per cent.; argon and other inert gases 0.94 per cent.; carbon dioxide 0.03 per cent.: hydrogen, ammonia, ozone and nitric acid 0.005 per cent.—Newth's "Inorganic Chemistry," pp. 256 and 270, 1920.

AMOUNT OF SEED WHICH MAY BE INOCULATED FROM ONE BOTTLE OF CULTURE.

The contents of a two-ounce bottle will inoculate approximately 20 to 30 lbs. of small seed, such as lucerne or subterranean clover, and 40 to 60 lbs. of larger seed, such as peas or soy beans. The eight-ounce bottle size will treat about four times the quantity of the smaller size.

TABLE I.

Approximate amount of seed which may be treated with one bottle of culture.

Size of bottle.	Price.	Seed of size of lucerne or sub-clover, etc.	Seed of size of garden pea, lupin soy beans, etc.	Milk required.	Calcium phosphate.
2 oz.	1s. 6d.	20 — 30 lbs.	40 — 60 lbs.	½ pint	3.0 gms.
8 oz.	2s. 6d.	80—120 lbs.	160—240 lbs.	1 quart	12.0 gms.

Owing to the time taken to prepare the cultures, farmers are requested to lodge their applications at the Department a fortnight or so before they wish to use the culture.

DIFFERENT BACTERIA REQUIRED FOR DIFFERENT KINDS OF LEGUMES.

The same strain of bacteria will not inoculate every kind of leguminous plant. Thus trefoils and lucerne are inoculated by the same kind, but the lucerne kind will *not* inoculate clovers or peas.

The bacteria which may be obtained from the Department will inoculate the following groups of legumes. *The members of each group are inoculated by the same kind of bacteria, but the plants mentioned in different groups require different bacteria.*

Group 1.—Subterranean clover, white Dutch clover, perennial red clover ("cow grass"), Egyptian clover, and all other true clovers (*Trifolium spp*).

Group 2.—Lucerne, white sweet clover, "King Island Melilot" ("Hexham scent"), medics, trefoils, and all other species of *Medicago or Melilotus.*

Group 3.—Garden pea, sweet pea, field pea, all kinds of vetches or tares, broad bean, tick bean, lentil.

Group 4.—W.A. blue lupin (*Lupinus varius.*)

Group 5.—Soy beans (*Glycine Max*).

Group 6.—Sulla (*Hedysarum coronarium*).

Group 7.—French beans (*Phaseolus vulgaris*).

Group 8.—Cow peas (*Vigna sinensis*).

DIRECTIONS FOR USING THE PURE CULTURES.

Keep the bottles unopened and in a warm, dark place until about to be used. The cultures are useful for at least one month after being received. In the bottles the bacteria appear as a whitish slime on the sloping *surface only* of the agar (*i.e.,* the jelly-like material containing bacterial food).

To inoculate the seeds with the cultures.

The seeds should first be piled on a clean surface. Then take *one half-pint* of fresh skimmed milk for every *two-ounce bottle*, or *one quart* of fresh skimmed

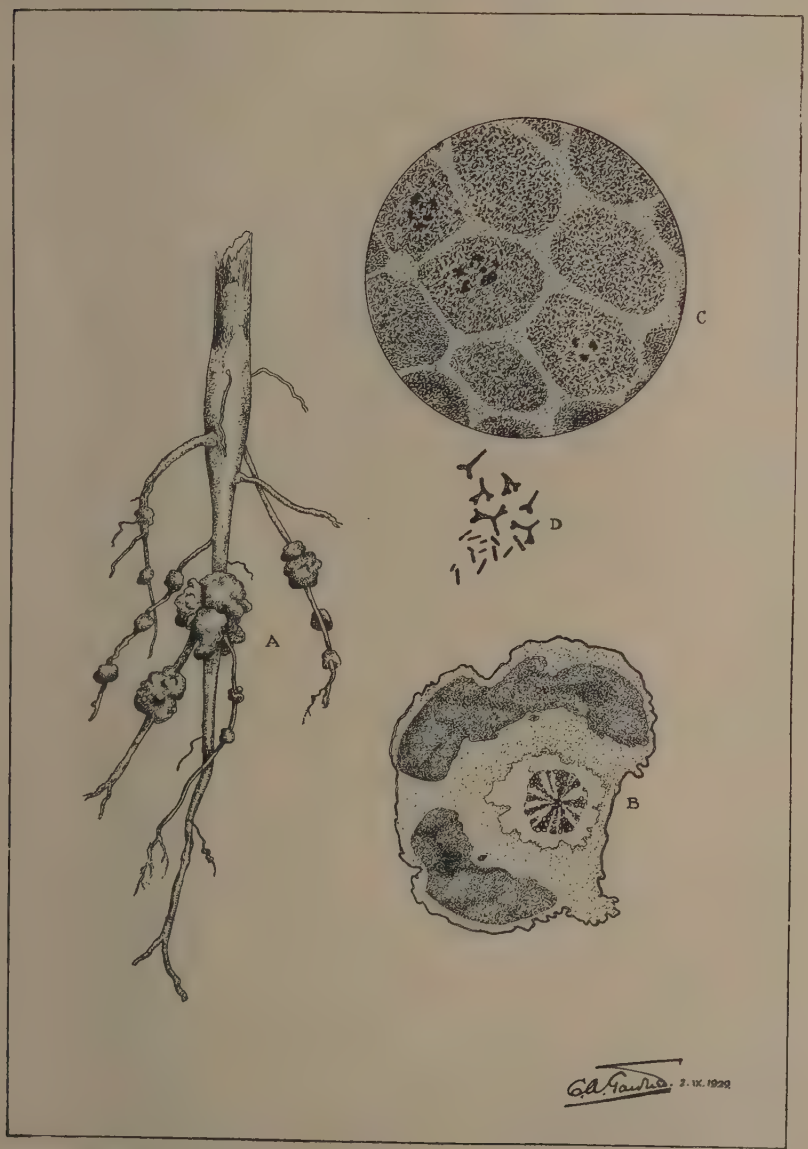


Fig. 1.—Nitrogen-fixing bacterial nodules on the root system of W.A. Blue Lupin plant (*Lupinus varius L.*)

a, Root system showing bacterial nodules (half natural size); b, Section through nodule (much enlarged), showing two darkly-shaded zones containing bacterial colonies; c, nitrogen-fixing bacteria in the plant cells; d, Branching and rod forms of nitrogen-fixing bacteria; (c and d taken from G. T. Moore, from Harshberger, "Mycology and Plant Patholgoy."). (*After C. A. Gardner, this Journal, Sept.* 1929.)

milk for every *eight-ounce medicine bottle*, of culture. Into the skim milk mix the powdered calcium phosphate supplied with every bottle of culture (3.0 gm. for each *two-ounce bottle*, 12.0 gm. for each *eight-ounce bottle*).*

Then transfer the whole of the agar contents of the bottle to the skim milk and *thoroughly* mix the bacterial slime with the milk. This may be done by pouring a little of the milk into the bottle and shaking vigorously and then pouring back into the rest of the milk. Repeat this procedure several times. When this has been done, pick out the lumps of agar (*i.e.*, the solid, whitish, jelly-like material), which will probably have become broken up into small pieces by the repeated shaking.

Now inoculate the seed by pouring a little of the inoculated milk on the heap of seed from time to time, and thoroughly mixing until every seed is moistened. The seed should not, however, be made too wet. If any of the inoculated skim milk is left over it should be mixed up with water and spread on a few yards of soil where the seeds are to be planted. On the other hand, if there is not quite enough inoculated milk to thoroughly moisten all the seeds, the vessel which formerly contained the inoculated skim milk may be rinsed out with further skim milk, and more added to the heap of seeds, until, on repeated mixing, every seed is uniformly moistened with the inoculated milk.

If sweet skim milk is not available, a commercial brand of powdered skim milk mixed up with water according to the maker's directions, or even plain water may be used instead. The milk is better, however, as it causes better adherence of the bacteria to the seed on drying.

It usually takes about one half-pint of milk to every 20 or 30 lbs. of small seeds such as lucerne, or 40 to 60 lbs. of large seed such as peas. The larger the seeds the less culture and skimmed milk required for inoculation, and *vice versa*.

SOWING.

The seeds should be sown as soon as possible after inoculation. If the seeds are too wet to sow they should be allowed to dry in a *cool shady* place. Under no circumstances should the cultures or the inoculated seeds be left exposed to the sunlight, as it tends to destroy large numbers of the bacteria. For this reason, also, the seed should be drilled, or, if broadcast, should be at once harrowed in. *The inoculated seed should not be sown at the same time as artificial fertilisers*, unless the fertilisers and inoculated seeds are run through separate drills or separate "runs" of the same drill, or are in some other way separately applied to the land, as the bacteria may be destroyed if in contact with the raw fertilisers for any length of time before reaching moist soil. If the seed is very small it may be mixed with bran, or soil, etc., for greater evenness of sowing through a drill. If the soil is moist at planting time, the inoculated seed may safely be run through the seed box, and the fertiliser from the fertiliser box of the same drill as the seed and fertiliser will only be in contact for a very short time before reaching the moist soil. Such a procedure is not permissible, however, if the soil is dry. Where possible, the safest plan is to sow the fertiliser in moist soil one day, and the inoculated seed a day or two later.

* The original directions received from Rothamsted (see Appendix I.) called for the use of water-soluble calcium phosphate in considerably smaller amounts than those indicated above. As this is not obtainable (as such) from the local druggists the powdered tri-calcium phosphate P.B. has been used instead.

WARNING—THE CULTURES ARE NOT A CURE-ALL.

Growers are warned that the *only* function of the nitrogen-fixing bacterial cultures—although an exceedingly important and valuable one—is to enable leguminous plants to make free use of the inexhaustible supplies of gaseous nitrogen in the air.

Without the presence of bacterial nodules the leguminous (pea family) plants, and indeed all other plants, find themselves, so far as this uncombined nitrogen is concerned, in somewhat the same situation as the sailors in Coleridge's story of the *Ancient Mariner,*—"Water, water, everywhere, nor any drop to drink."

Nitrogen is an essential food material for all plants. By most species, however, it can only be obtained, in spite of its very great abundance in an uncombined form in the atmosphere (*see* footnote to the second page of this article), in the form of compound substances (nitrates, urea, ammonium carbonate, etc.). Such compound nitrogenous substances are formed in the soil as a result of the decomposition of organic matter (plant or animal matter) or from such artificial fertilisers as sulphate of ammonia, nitrate of soda, ammonium phosphate, and so on.

Where other kinds of plants would fail to thrive because of a deficiency of combined nitrogen in the soil, legumes may succeed splendidly, provided they are equipped with nitrogen-fixing bacterial nodules on the roots.

These nodules *cannot,* however—

(1) Take the place of good drainage.

(2) Remove salt from the soil.

(3) Provide other necessary food materials such as lime, phosphoric acid, or potash.

(4) Prevent plant diseases or insect pests; and so on, as some farmers in the past appear to have imagined.

CONCLUSION.

Where combined soil nitrogen is the limiting factor in the growth of crops it can be provided most cheaply by the growing of leguminous crops from inoculated seed, and by the feeding off *in situ* or ploughing under of such plants before other crops are sown. The bacterial cultures have no mystical properties, however, and can do nothing else but supply nitrogen to the legumes in the cheapest possible way.

It may be mentioned here that it will often be found of great value in the successful establishment of leguminous crops to broadcast approximately one or two tons of freshly slaked lime per acre several months before sowing the seed. The lime will remove soil acidity (sourness), improve the physical, chemical, and biological properties of the soil, and greatly stimulate the development of the nitrogen-fixing bacteria.

USERS ASKED TO REPORT RESULTS OBTAINED FROM THE USE OF THE CULTURES.

It would be greatly appreciated if persons using the cultures would sow several rows of uninoculated seed before opening the bottle, or bottles, and then subsequently plant the inoculated seed alongside, using the same fertiliser, etc., and report any differences in growth or yields, etc.

APPENDIX I.

History of the Distribution of Nitrogen Fixing Bacterial Cultures in W.A.

In 1926 this Department obtained a pure culture of the lucerne root organism (*Rhizobium radicicola*), from the Rothamsted Experiment Station, England, on the initiative and through the good offices of Mr. F. W. Strack, General Manager of the Primary Producers' Bank of Australia, London, England.

This organism was subcultured and distributed to farmers in various parts of the State by the then Botanist and Plant Pathologist, Mr. W. M. Carne, with the result that successful stands were obtained in many places where success with this crop had previously not occurred. The same strain has been grown on artificial media ever since, and is still being distributed to farmers in this State, who are using it with great success.

With the passage of time, nitrogen fixing bacteria for other kinds of leguminous plants have gradually been acquired from various sources. Wherever farmers have planted uninoculated seed alongside inoculated, they have almost invariably reported an enormous difference in favour of the treated seed.

This is readily understandable, as Western Australia and particularly the extreme South Western portion of it, is agriculturally very young, so that in nearly every instance leguminous crops are planted on soil which has not previously grown the same crop or a crop carrying the same kind of organism on its roots. In many cases burnt-over forest country or newly cleared land is planted so that it is just as necessary to introduce the appropriate bacteria from an outside source, as to introduce the seed of the crop itself.

By the use of the cultures it has been found that a good stand of subterranean clover, for example, may be obtained in the first year from clean machined seed, whereas from similar seed in the ordinary way a satisfactory stand does not usually result on new ground until the third or fourth season after sowing.

The following extracts have been taken from Annual Reports of the Plant Pathologist from 1928-9 onwards. No information is given in the reports for 1926-7 and 1927-8 as to the numbers of cultures sent out to farmers during those periods.

Annual Report, Plant Pathologist, 1928-9.

"Distribution of lucerne root bacteria, 37 test tubes. In connection with the distribution of lucerne-root bacteria, farmers in the Group Settlements, etc., who have availed themselves of the cultures when establishing lucerne beds have expressed great satisfaction at the results."

Annual Report, Plant Pathologist, 1929-30.

"Distribution of lucerne-root bacteria	134 test tubes.
Distribution of soy bean-root bacteria	42 test tubes.
Distribution of pea-root bacteria	16 test tubes.
Total	192

"In addition to the continued and increasing distribution of tubes of lucerne root bacteria, the branch is now in a position to supply farmers with appropriate nitrogen-fixing bacteria for inoculating the seeds of peas, clovers or soy beans before sowing.

"The clover and pea bacteria were obtained from the Urbana Laboratories, Urbana, Illinois, U.S.A., through the courtesy of Mr. A. T. O'Connell, Dwarda, who was having great difficulty in the successful establishment of field and Tangier peas prior to the importation of the pea culture.

"During the autumn months Westralian Farmers, Ltd., imported considerable quantities of soy bean seeds for distribution in small parcels to farmers for experimental purposes. As the soy bean will only make satisfactory growth when inoculated with a particular strain of the nitrogen fixing organism *Rhizobium radicicola*, arrangements were entered into whereby the Branch agreed to supply any farmers purchasing the seed with the requisite organisms at the price of 1s. per tube. This sum barely covers the cost of materials and postage.

"The original soy bean culture was supplied by Westralian Farmers." (Subsequently, in 1933, a second soy bean culture was forwarded to this Department with soy bean seed, by the Ford Motor Co., of Canada.)

Annual Report, Plant Pathologist, 1930-31.

"Distribution of nitrogen-fixing bacterial cultures:—

Lucerne	34	test tubes	5	(8 oz.)	bottles
Peas	29	„	34		„
Soy Beans	46	„	—		
W.A. Blue Lupins ..	8	„	23		„
Clover	10	„	9		„
Total	127	„	71		

Grand Total—198.

"This Branch is at present supplying nitrogen-fixing bacterial cultures to farmers for inoculating peas, clovers, lucerne, soy beans or W.A. blue lupin at a nominal charge of 1s. 6d. for a tube containing sufficient to inoculate 15 lbs. of small seeds such as lucerne, or 30 lbs. of larger seeds such as peas. The medicine bottle size for 2s. 6d. contains sufficient to inoculate about 120 lbs. of small seeds such as lucerne and 240 lbs. of large seed such as peas.

"These cultures have been greatly appreciated by the farming community, and following an article by the writer in the March issue of the 'Agricultural Journal' for 1931, the demand for them became so great that considerable difficulty was experienced in keeping the supply up to it. The W.A. blue lupin organism was isolated in this laboratory by Mr. H. G. Elliott."

Annual Report, Plant Pathologist, 1931-32.

"Nitrogen-fixing bacterial cultures:—

	2 oz. bottle size.	8 oz. bottle size.
(a) Lucerne	110	13
(b) Peas	16	35
(c) Soy Beans	3	1
(d) W.A. Blue Lupins	2	5
(e) Clovers	6	6
(f) Miscellaneous	20	—
	157	60

Grand Total—217."

Annual Report, Plant Pathologist, 1932-33.

"So successful have been the results obtained by farmers in the establishment of leguminous crops such as subterranean clover, lupins, lucerne, Tangier peas, etc., during the first year on new land by the inoculation of the seed before planting, that the demand for the pure cultures supplied by this laboratory continues to increase, some 270 odd having been prepared and supplied during the past year. During this period the organisms required for the inoculation of sulla (*Hedysarum coronarium*) and cow peas (*Vigna sinensis*) were isolated in pure culture in this laboratory. The sulla organism was isolated by Miss J. Hearman and the cow pea organism by Mr. B. Williams. The French bean organism was obtained by courtesy of the N.S.W. Department of Agriculture. The following table shows the number of each kind of culture supplied during the year:—

	Size 2 oz. medicine bottle.	Size 8 oz. medicine bottle.
Lucerne	140	12
Clover	28	12
W.A. Blue Lupins	5	14
Peas	37	16
Cow Peas	2	1
Sulla	0	0
Soy Bean	5	0
French Bean	1	0
	218	55

Grand Total—273.

This represents an increase of 56 cultures over our previous record of 217 in 1931-32."

Cultures from 1st July, 1933, to November 28th, 1933.

	Size 2 oz. medicine bottle.	Size 8 oz. medicine bottle.
Cow Pea	189	7
Lucerne	40	7
Soy Bean	11	0
Peas	23	15
Clover	2	0
French Bean	5	0
Sulla	1	0
W.A. Blue Lupin	1	0
	272	29

Grand Total—301.

APPENDIX II.

Preparation of Legume Root Soy Bean Agar for Growth of Nitrogen fixing Bacteria.

The method of preparation of agar media for the growth of nitrogen-fixing bacteria in this laboratory, which has been used with great success since 1930, is given below for the sake of workers in other laboratories who may be interested.

The formula is a modification of that originally received from the Rothamsted Experiment Station, England, with our first lucerne culture. All the organisms listed above as being supplied to farmers, are grown on the same agar with great success.

The soy beans were first introduced into the formula when our first soy bean culture was received, and we were unable to obtain any soy bean roots. So vigorous was the growth made by all the strains of the organism as a result of the modification, that soy beans have been used in making up the agar ever since. When the sulla organism was first isolated, it did not seem to be able to grow on this agar and was grown for a time on agar similarly prepared except that sulla roots were used instead of the lucerne, trefoil or "Hexham Scent" roots normally used. Now, however, it grows quite well on our usual agar.

To Prepare Legume Root Soy Bean Agar for the Growth of Rhizobium Radicicola.

Take 50 gms. well washed roots of lucerne (*Medicago sativa*), or burr trefoil (*Medicago denticulata*) or "Hexham scent" (*Melilotus indica*) (or mixtures of these). Burr trefoil roots give the most vigorous growth on the whole, followed by "Hexham scent" and then lucerne. Add 10 gms. soy beans. Mince well in meat mincer or chop up finely. Add three times the volume of water. Boil one hour, and then stand 24 hours. Filter through cotton wool and make the extract up to 1,000 ccs. Add the following chemicals:—

Dipotassium monohydrogen phosphate ..	1.0 gm.
Magnesium sulphate	0.2 gm.
Sodium chloride	0.1 gm.
Calcium chloride	0.1 gm.
Ferric chloride (2 drops concentrated solution)	0.02 gm.
Agar—	
In Winter	20 gms.
In Summer	25 gms.

Dissolve the agar by autoclaving. Filter through cotton wool and add—

Calcium carbonate	5 gms.
Sucrose	10 gms.

Keep the agar well agitated by constant movement of the flask so as to ensure even distribution of the calcium carbonate.

Pour into medicine bottles, etc., sterilise 20 minutes at 15-20 lbs. pressure and slope.

KOJONUP PASTURE COMPETITION, 1933.

A. S. Wild,
Agricultural Adviser.

The 5-acre pasture competition conducted by the Kojonup Agricultural Society in 1933 was divided into two sections. Of these No. 1 Section was for competitors whose properties are located in portions of the district enjoying a higher rainfall—probably about 2 inches more than that of Kojonup townsite—and No. 2 Section for that portion of the district nearer Kojonup.

The rainfall as recorded at Kojonup from April to October is as hereunder:—

April.	May.	June.	July.	August.	Sept.	October.	Total growing period.
62	238	652	231	407	227	256	20.73 inches.

The inspection of the competing pastures was made about November 6th, the awards being made as follow:—

Section 1.

Competitor.	Yield.	Freedom from Weeds.	Useful Grasses.	Freedom from Disease.	Evenness of Growth.	Total.
	40 pts.	15 pts.	15 pts.	15 pts.	10 pts.	100 pts.
Cassey, P.	36	14	14	13	9	86
Cavanagh, M. F. ...	36	13	13	14	9	85
Roche, H. L. ...	30	13	12	13	8	76
Lewis, G. N. ...	25	13	13	13	7	71

Section 2.

Competitor.	Yield.	Freedom from Weeds.	Useful Grasses.	Freedom from Disease.	Evenness of Growth.	Total.
	40 pts.	15 pts.	15 pts.	15 pts.	10 pts.	100 pts.
Partridge, A. W. ...	27	14	14	13	8	76
Milne, D.	22	13	12	13	7	67

First place in Section 1 was awarded to Mr. P. Cassey's entry, a pasture composed chiefly of subterranean clover and Wimmera rye grass.

The land had originally carried jarrah and white gum timber and had been cleared, ploughed and planted in 1930. Subterranean clover had been sown at the rate of 1½ lbs. per acre and superphosphate applied at 90 lbs. per acre. During each of the succeeding years 90 lbs. of superphosphate per acre were applied as a topdressing in the early part of the season. During this year an additional 90 lbs. dressing was applied in August. The pasture had been stocked this year during the early part of the season only.

Mr. M. F. Cavanagh's entry had been established about 12 years previously on red gum, white gum and flooded gum country. The fallowed land had been planted with oats and 1 lb. of subterranean clover per acre. At various times since it had been topdressed with 90 lbs. of superphosphate per acre applied in April. This dressing was applied in 1931 but not in 1932, while in 1933 two dressings, each of 90 lbs., were applied in May and August respectively. This year the pasture had been stocked up to the middle of June.

Mr. H. L. Roche's competition pasture was also on land which had originally carried red gum, white gum and flooded gum timber. The land, which had been cleared for many years, was ploughed about 1926 and planted with oats and 1 lb. of subterranean clover per acre. Superphosphate was applied at 90 lbs. per acre, this amount being reduced to 70 lbs. for the succeeding annual topdressings each April. During 1933 an additional 90 lbs. topdressing was applied in August. This pasture was fairly heavily grazed up to the end of June.

No information concerning the early history of Mr. G. N. Lewis's pasture plot was available. The original timber was red gum and blackboys which had been cleared many years ago. Two topdressings, each of 70 lbs. of superphosphate per acre, were applied in 1931, and one of 56 lbs. in 1932. The pasture also received two dressings (each of 70 lbs. per acre) during 1933, one applied in April and the other in August. It had been stocked up to late September.

Mr. A. W. Partridge's entry, which was awarded first place in Section 2, was a very fine pasture composed chiefly of subterranean, drooping flower and crimson clovers, soft brome and fine grasses, and some hop and yellow suckling clovers. It had been established on land which had been cleared of its jam, sheoak, and red gum timber in 1930. During the same year it was ploughed and planted with oats and a mixture of clover seeds. Of these, subterranean clover was planted at 2 lbs. per acre, crimson clover at ½ lb., and drooping flower clover at ¼ lb., with superphosphate at 90 lbs. per acre. This application of fertiliser has been repeated in April and again in August during each of the succeeding years. This pasture, which was a very fine entry, had been stocked up to the end of September.

The pasture plot entered by Mr. D. Milne had been established in 1927 on jam, sheoak, white gum and flooded gum country which had been cleared for many years. The fallowed land had been planted with oats and 1 lb. of subterranean clover per acre, together with a dressing of 90 lbs. of superphosphate. This rate of application of the fertiliser had been continued for the three succeeding years and then after 1930 reduced to 60 lbs., applied in April. During 1933 this was supplemented by an additional 60 lbs. applied in August. The pasture had been heavily stocked up to the middle of August.

The entries inspected in Section 2 would have shown to better advantage if inspected a few days earlier, as they were affected by the warm, dry weather conditions.

However, all the pastures of both sections were of a high standard, some being calculated to yield up to 13 tons of green fodder per acre.

CHEMICAL WEED KILLERS.

The Chlorates of Sodium and Calcium.

G. R. W. Meadly, B.Sc.,
Botanical Branch.

From time to time various chemicals have been used in attempting to eradicate weeds. Common salt applied in comparatively large quantities, has met with some success, but the soil does not recover its productive powers for a considerable time after application. Copper sulphate (bluestone), iron sulphate, and sulphuric acid have been employed, usually in weak solutions, mainly for the destruction of weeds such as charlock in crops. Sulphate of ammonia has proved quite effective in checking weeds, particularly clovers in lawns. Sodium arsenite is quite a useful plant poison, particularly for killing green timber after ringbarking. Its definitely poisonous character to animals, however, is one factor which prevents its general use for weed destruction. Various refuse oils and waste products from gas works, etc., have been used with varying degrees of success.

Weedicides which have come under notice during recent years are arsenic pentoxide and the chlorates of sodium and calcium. New Zealand experiments by Levy and Madden (1) showed that arsenic pentoxide is appreciably selective in its action, when applied to lawns at a strength of 1-80, *i.e.*, 1 lb. to 8 gallons of water, at the rate of about 240 gallons per acre, a good kill of weeds is recorded associated with a browning, but comparatively quick recovery of the grasses.

Sodium and calcium chlorates have received particular attention during the last few years, and besides being sold commercially under these names, are included to a greater or lesser extent in a number of trade preparations. One of the first experiments carried out in America demonstrated that Johnson grass could be successfully controlled by the application of a 10 per cent. solution of sodium chlorate in spring followed by a further spray in summer, to kill any plants which may have survived the first application. Since then, very promising results have been obtained with sodium chlorate on such serious weeds as Field Bindweed (*Convolvulus arvensis*) (W. L. Latshaw and J. W. Zahnley) (2), Ragwort (*Senecco Jacoboea*) (J. W. Deem) (3) and (4), Blackberry (*Rubus fruticosus*) (3), Californian Thistle (2), Gorse (*Ulex europaeus*) (3), Creeping Buttercup (*Ranunculus repens*) (5).

In our local experiments and most of those carried out in other parts of the world sodium chlorate has proved more satisfactory than calcium chlorate. It is a white crystalline substance which is readily soluble in water, but when applied to vegetation, unlike most other weedicides, some time elapses before any changes are apparent. The supposed action when a plant is sprayed, is for the solution to pass into the leaves through the stomata and then proceed down the conducting portion of the leaves and stems to the roots. Examinations made of Bindweed roots (2) showed that normally the cells were filled with starch granules and the cell walls were intact. On the other hand, roots from the plants treated with sodium chlorate were characterised by the absence of starch granules and the cell walls in many cases showed unmistakable signs of disintegration.

Just why sodium chlorate affects the plants as it does is not known. Observations indicate that it interferes with photosynthesis, the building up processes, and compels the plant to draw upon the food reserve in the roots, until the supply is exhausted and death occurs.

RESULTS OF EXPERIMENTS.

1. Commercial calcium chlorate.—On 20th January, 1931, small areas in the Plant Introduction plots at Perth were sprayed with 5 per cent., 10 per cent., and 15 per cent. solutions of commercial calcium chlorate, using a fine spray and applying until the foliage of the plants was completely covered. The main plants present were:—

Anagallis spp. (Pimpernel).
Chenopodium ambrosioides (Ant weed).
Cynodon dactylon (Couch Grass).
Digitaria marginata (Summer Grass).
Echinochloa colona (Barnyard Millet).
Medicago denticulata (Burr Trefoil).
Melilotus indica (King Island Melilot).
Nasturtium officinale (Water Cress).
Paspalum dilatatum (Paspalum).
Plantago major (Rib Grass).
Polygonum aviculare (Wire Weed).
Polypogon monspeliensis (Beard Grass).
Portulaca oleracea (Purslane).
Ricinus communis (Castor Oil).
Rumex spp. (Docks).
Solanum nigrum (Nightshade).
Sonchus oleracea (Milk Thistle).
Stellaria media (Chickweed).
Villarsia spp (Wild Violet).
Cyperus spp. (Nut Grass, etc.).

Although at the end of the first day after spraying several plants, particularly Nightshade and Docks, were showing decided signs of wilting, with the exception of the 15 per cent. portion the majority of the plants recovered. The 5 per cent. was of little or no use; the 10 per cent. produced a drying effect, killing a few of the less hardy plants, whereas the 15 per cent. apparently destroyed a number of plants, the young Nut Grass in particular being affected.

Further experiments were carried out with 15 per cent. solution on blackberries at Jarrahdale. Although at the end of the first week the leaves were considerably shrivelled, the plants soon recovered and produced normal shoots.

From the results obtained it is evident that commercial calcium chlorate is not particularly satisfactory as a weed killer, for even when using a 15 per cent. solution the results obtained were not impressive.

2. Sodium chlorate.—A corresponding series of experiments were carried out using varying concentrations of sodium chlorate. On the experimental plot it was found that a 5 per cent. solution, in general, was sufficient to kill the Castor Oil plants. With this strength some of the Nightshade recovered, but with 10 per cent. and 15 per cent. solutions the Nightshade, Nut Grass, and majority of other weeds were apparently killed. The 15 per cent. produced more marked results than the 10 per cent. and a greater drying effect was noted.

Five per cent., 10 per cent., and 15 per cent. solutions were used in spraying Blackberries at Jarrahdale. The 15 per cent. solution was first used (5th February), and in a fortnight all the leaves were dried and the branches were also wilting back considerably. Five weeks after application a very limited number of green leaves were evident (12 March), and the plants were then burned.

Three weeks after spraying with 5 per cent. and 10 per cent. solutions the plants were wilted back, apparently to the same extent as with the stronger solu-

tion, and no new shoots were evident. This effectiveness of the weaker solutions may be due to the slower wilting produced in the leaves and consequently the increased opportunity to take in more of the solution before plasmolysis occurs.

The burning gave the plants a further set back and the dead stems were slashed away. A few shoots which appeared later were sprayed with a 10 per cent. solution, which in most cases gave complete control. Observations indicated that if the dry stems are burned at all, the burning should not take place until the chlorate has had every opportunity to produce maximum results. This time would vary with different plants and under different conditions, but should not be less than one month.

Similar results have been obtained with Blackberry in the Eastern States and New Zealand, but in order to meet with reasonable success the work must be carried out thoroughly and when conditions are most satisfactory.

Local experiments with Cape Tulip (*Homeria collina and H. miniata*) have not proved very satisfactory, the best results having been obtained with a 10 per cent. solution. The leaf surface is comparatively smooth and hard, thus not tending to retain the spray. The time of spraying is particularly important, owing to the formation of bulbils around the main corm and also in the axils of the leaves. If spraying is not carried out before their formation and separation the reduction brought about by killing the old plant is not very appreciable. Formation of bulbils usually commences about the middle of August. Cape Tulip has been eradicated in South Australia by sodium chlorate spray (6).

Couch grass is severely burned by a 15 per cent. solution, but a large percentage usually recovers if general growth conditions are favourable, and further applications are therefore necessary. If spraying is repeated sufficiently, eradication may be secured, but the limiting factor is the cost of the material when considered from a practical viewpoint.

METHOD OF APPLICATION.

Calcium and sodium chlorate may be applied either as a solution or in the crystalline form. Generally the spray method is more efficient and less material is required although labour is more expensive (4).

When using in the dry form it is advisable to employ a spreader, and when carbonate of lime can be procured at a reasonable price it is the best to use. Any material, however, so long as it is dry and fine enough and does not contain any organic or sulphurous matter, is suitable. The dissolving of sodium chlorate in water and then spraying on to the spreader would appear to be the easiest and most effective method of mixing for dry purposes.

When a solution is used the leaf surface should be completely covered with a fine spray, while when using the dry material a complete dusting should be given. If not too numerous the crowns of perennial herbs should be injured before dusting.

TIME OF APPLICATION.

It is generally accepted that the most suitable time to apply the sprays is when the plants are in full bloom, the application being made in sunlight. Action is more rapid when the air is moist, and rain following a short time after spraying does not hinder the action, and in some instances the kill has been more complete when rain followed a few hours after spraying. Seeds are not readily destroyed by the spray, which should therefore be applied prior to seed formation. Thus the optimum period of attack is rather limited.

The increased effectiveness of the treatment as the plants approach maturity may be attributed to the more fibrous nature and the ease of dissemination of the chemical through the rooting system.

Treatments are considered more effective if the water table is more or less stationary or slightly lowering at the time of application.

It is not advisable to attempt spraying in the winter, and cultivation prior to application of chlorates is not recommended.

STRENGTH OF SOLUTION.

Naturally the strength of solution required, varies with the type of weed and stage of growth when applied. Most soft, shallow rooted annual weeds are destroyed by a 2½ per cent. solution (¼ lb. to one gallon water), but for general use a 10 per cent. solution (1 lb. to 1 gallon water) is most satisfactory. For average weed infection about 100 gallons per acre is sufficient for a single spraying, but in the case of blackberry thickets, etc., as much as 500 gallons and even more may be required. When applying crystals instead of spraying, larger quantities of material are required, but the expense of application is not so great. As an example in New Zealand experiments on Ragwort (4), better results were obtained with 24 lbs. per acre of sodium chlorate sprayed in the form of a 5 per cent. solution than with 28 lbs. broadcasted in the dry state with 5 cwt. of lime as a spreader

SPRAYING APPARATUS.

For general use a knapsack sprayer of about three gallons capacity is the most serviceable. This should be fitted with a trigger spray to prevent waste. The nozzle should produce a very fine spray so as to enable the whole leaf surface to be covered without undue loss of material.

When large areas are to be treated a power spray is essential. In America these are almost always mounted on motor trucks as shown by the photographs taken from an article by Ball, Madson & Robbins (7).

EFFECT ON SOIL AND TREES, ETC.

Sodium chlorate, when used for spraying weeds, has only a temporary injurious effect of the soil, affecting crops sown very soon after spraying. The period which must elapse before it is safe to sow crops will largely depend on the amount of rainfall subsequent to spraying. The surface soil generally becomes entirely free of the substance in three to eight months, and crops can be safely sown during the season succeeding the application.

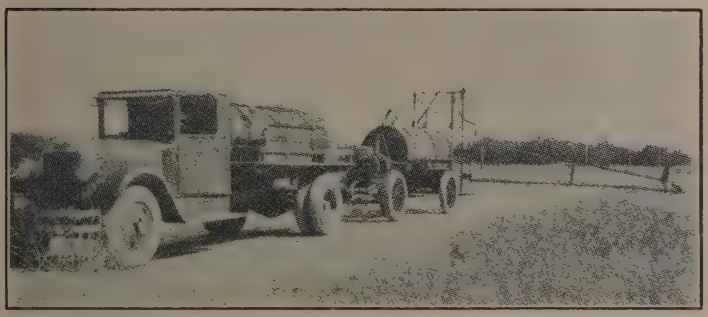
Some authorities state that only light applications should be made in orchards: others have found that two or three sprayings of 100 lbs. per acre can be safely used to kill Bindweed growing round trees and shrubs. Deep rooted trees are certainly not likely to be injured by chlorates applied around them (8). It has been shown that the process of nitrification in the soil is temporarily retarded by the application of this spray (8).

POISONOUS PROPERTIES.

Work carried out by Seddon and McGrath (9) definitely proved that sodium chlorate is toxic to stock if ingested in sufficient quantities, but as it is generally used as a 10 per cent. solution and usually sprayed lightly over vegetation, it would seem unlikely that sheep or cattle would eat sufficient of the sprayed vegetation to do harm. J. W. Deem (3) recorded cows eating quantities of thistle tops with apparent relish and no ill effects, a few days after they had been sprayed. During our own tests on blackberries at Jarrahdale, cattle were grazing in the paddock while the spraying was being done, apparently with no adverse results.

Probably the greatest danger would arise through leaving bags of sodium chlorate or mixed solution where stock would have access to it, although to eliminate all risk stock may be removed from the treated areas.

Power spray rig, showing two lines of hose with multiple nozzle.



Power spray rig, built for roadside spraying. Will spray a strip 15 feet wide. Capacity, 900 gallons.

Power spray equipment adapted for spot work along roads. Two lines of hose.

[From California Agricultural Extension Service—Circ. 54.]

DANGEROUS PROPERTIES.

Sodium and calcium chlorates are strong oxidising agents and easily inflammable when dry, so that users are advised to thoroughly wash clothing that may become saturated with the solution during spraying operations. When working with these substances it is advisable to wear rubber shoes, as ordinary leather becomes saturated with the solution.

All apparatus in which the chemicals have been used should be thoroughly cleaned by rinsing several times in water. Clothing, straw or chaff mixed with the solution and permitted to dry may be ignited by friction or a spark. While quite safe to handle by themselves these chlorates form explosive mixtures with a number of other substances such as strong acids, sulphur and sugar. This should be remembered if spreaders are added at any time to aid an even distribution.

Although several painful accidents have occurred in New Zealand and America, if reasonable care is exercised with sodium and calcium chlorates no trouble should be experienced.

CONCLUSIONS.

Sodium chlorate has definitely proved superior to calcium chlorate in most trials which have been carried out. If applied often enough there are evidently few weeds which it will not kill, but the price of material is a decided limiting factor from a practical viewpoint. Chlorate sprays will rarely prove profitable on appreciable areas containing weeds which may be eradicated by cultivation. Their use in the eradication of poison plants such as York Road Poison (*Gastrolobium calycinum*) and Box Poison (*Oxylobium parviflorum*) is not recommended.

Although trials with sodium chlorate, both locally and in other parts, have proved to a large extent very successful, it must be remembered that thoroughness is essential in order to obtain satisfactory results. Care in completely mixing solutions, applying in a fine spray at the correct stage of growth and under suitable conditions must all be considered when attempting the eradication of weeds with chlorate sprays.

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FERTILISERS.

N. Davenport,
Inspector of Fertilisers.

A new fertiliser year for the State commenced on 1st November last, and in accordance with the provisions of the Fertilisers Act, 1928, the current registrations (effected to 1st December) are appended in tabular form.

From the retail prices per ton, and the registered percentages of the various fertilising ingredients present in the fertilisers, the unit values for the different forms of nitrogen, phosphoric acid, and potash have been calculated and are shown below, together with those of 1932 and 1933 for comparison.

The main variations from last year's figures are, a reduction of 3d. per unit in the water and citrate soluble forms of phosphoric acid and a rise of 1s. 4d. per unit for ammoniacal nitrogen, as sulphate of ammonia. The unit cost of nitrogen in blood and bone and bonedust has fallen 1s., and for the same class of fertilisers the phosphoric acid has been reduced 3d. and 9d. per unit respectively.

The prices of potash have remained constant.

UNIT VALUES.

	1932.	1933.	1934.
	s. d.	s. d.	s. d.
Nitrogen (N) as—			
Blood and Bone, Bonedust and Bone and Flesh ...	24 0	24 0	23 0
Nitrate	20 3	19 10	19 11
Ammonia	12 6	11 0	12 4
Phosphoric Acid (P_2O_5) as—			
Water Soluble	4 2	4 2	3 11
Citrate Soluble	4 2	4 2	3 11
Acid Soluble in Bonedust	6 6	6 6	5 9
" " Blood and Bone, and other animal fertilisers	5 6	5 6	5 3
Basic Phosphate	5 6	5 6	5 6
Superphosphate and Rock Phosphate	2 6	2 6	2 6
Potash (K_2O) as—			
Sulphate	7 4	8 5	8 5
Muriate	5 8	6 7	6 7

The following fertilisers have been registered at the Department of Agriculture under the Fertilisers Act, 1928, for the year commencing 1st November, 1933:—

Name of Fertiliser.	Brand.	By whom Registered.	Nitrogen (N) as:				Phosphoric Acid (P_2O_5) as:				Potash (K_2O) as:		Price per ton on rails at Works or Perth.
			Nitrate.	Ammonia.	Blood & Bone.	Bone-dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total.	Sulphate.	Muriate.	
A.—MINERAL.			%	%	%	%	%	%	%	%	%	%	£ s. d.
1.—NITROGENOUS.													
(a)—Nitrogen as Nitrate.													
Nitrate of Soda	Sickle A. ...	Cuming Smith Mt. Lyell F.F., Ltd.	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do.	ML in diamond ...	do. do. ...	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do.	C.S.M.L.	do. do. ...	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	15·0	...	...	...	...	...	...	...	...	...	15 14 0
(b)—Nitrogen as Ammonia.													
Sulphate of Ammonia ...	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	20·5	...	...	...	...	...	...	...	...	12 12 0
Do.	ML in diamond ...	do. do. ...	...	20·5	...	...	...	...	...	...	...	...	12 12 0
Do.	C.S.M.L.	do. do. ...	...	20·5	...	...	...	...	...	...	...	...	12 12 0
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	20·0	...	...	...	...	...	...	...	...	12 12 0
Do.	ICI in circle ...	F. Viles	...	20·6	...	...	...	...	...	...	...	...	12 12 0
2.—PHOSPHATIC.													
(a)—Rock Phosphates.													
Pacific Island Phosphates ...	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Do. do. ...	ML in diamond ...	do. do. ...	...	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Do. do. ...	C.S.M.L.	do. do. ...	...	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Phosphate Powder	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	...	...	34·80	34·80	...	...	4 10 0
(b)—Superphosphates.													
Florida Super. (22)	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 5 0
High Grade Super. (22) ...	ML in diamond ...	do. do. ...	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 5 0
High Grade Super. (22) ...	C.S.M.L.	do. do. ...	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 5 0
22 Super.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 5 0
Florida Super (24)	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0
High Grade Super (24) ...	ML in diamond ...	do. do. ...	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0
High Grade Super. (24). ...	C.S.M.L.	do. do. ...	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0
24 Super.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0

(c)—Rock Phosphate and Superphosphates.											
Phosphate Mixture (50/50)	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do. ...	ML in diamond ...	do. do. ...	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do. ..	C.S.M.L.	do. do. ...	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
50/50 Phosphate	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	9·16	1·84	17·4	28·4	...	...	4 10 0
(d)—Basic Phosphates.													
Basic Phosphate	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Do.	ML in diamond ...	do. do. ...	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Do.	C.S.M.L.	do. do. ...	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
3.—POTASSIC.													
(a)—Potash as Sulphate.													
Sulphate of Potash	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	...	...	...	...	48·6	...	20 11 6
Do.	ML in diamond ...	do. do. ...	...	...	...	...	...	...	...	...	48·6	...	20 11 6
Do.	C.S.M.L.	do. do. ...	...	...	...	...	...	...	...	...	48·6	...	20 11 6
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	...	...	...	...	48·5	...	20 0 0
Do.	Sun	Westralian Farmers Pty., Ltd.	...	...	...	...	...	...	...	...	48·6	...	20 11 6
(b)—Potash as Muriate.													
Muriate of Potash.	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do.	ML in diamond ...	do. do. ...	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do.	C.S.M.L.	do. do. ...	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Do.	Sun	Westralian Farmers Pty., Ltd.	...	...	...	...	...	...	...	...	...	50·0	16 15 0
30 % Potash Salts ...	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	...	...	...	...	...	50·0	16 11 6
Kainit	Sun	Westralian Farmers Pty., Ltd.	...	...	...	...	...	...	...	...	...	30·0	8 10 0
Potash Manure Salts ...	do.	do. do. ...	...	...	...	...	...	...	...	...	...	14·0	*
												30·0	*
4.—NITROGEN AND PHOSPHORIC ACID.													
Super, and Ammonia ...	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	...	...	...	...	...	...	...
Potato Manure C	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 6 6
Potato Manure F	do.	do. do. ...	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	7 1 6
Super. and Ammonia, No. 1	do.	do. do. ...	...	1·5	...	...	16·0	·4	2·1	18·5	...	...	5 9 0
Do. do. No. 2	do.	do. do. ...	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 6 6
Do. do. No. 3	do.	do. do. ...	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	7 1 6

* Prices not available.

FERTILISERS—*continued.*

Name of Fertiliser.	Brand.	By whom Registered.	Nitrogen (N) as:				Phosphoric Acid (P_2O_5) as:				Potash (K_2O) as:		Price per ton on rail at Works or Perth.
			Nitrate.	Ammonia.	Blood & Bone.	Bone-dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total.	Sulphate.	Muriate.	
			%	%	%	%	%	%	%	%	%	%	£ s. d.
Potato Manure No. 2 ...	M.L. in diamond ...	Cuming Smith, Mt. Lyell F.F. Ltd.	...	3·5	..		15·0	·4	1·6	17·0	...	..	6 6 6
Do. No. 6 ..	do. ...	do. do.	..	6·0	.		13·5	·4	1·6	15·5	...	.	7 1 6
Super and Ammonia No. 1...	do. ...	do. do.	...	1·5	...	...	16·0	·4	2·1	18·5	..	..	5 9 0
Do. do. No. 2 ...	do. ...	do. do.	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 6 6
Do. do. No. 3 ...	do. ...	do. do.	...	6·0	...	...	13·5	·4	1·6	15·5	..	...	7 1 6
Potato Manure C	C.S.M.L.	do. do.	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 6 6
Do. F	do.	do. do.	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	7 1 6
Super and Ammonia No. 1 ...	do.	do. do.	...	1·5	...	...	16·0	·4	2·1	18·5	...	...	5 9 0
Do do No. 2 ...	do.	do. do.	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 6 6
Do. do. No. 3 ...	do.	do. do.	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	7 1 6
5. NITROGEN, PHOSPHORIC ACID AND POTASH													
Potato Manure B	Sickle	do do.	...	3·75	...	...	14·5	·35	·75	15·6	4·5	...	7 16 6
Do. L	do	do. do.	...	3·50	...	...	14·0	·30	·70	15·0	8·0	...	8 16 6
Do. G	do.	do. do.	...	3·50	...	...	10·5	·20	·60	11·3	16·0	...	11 6 6
Do H	do.	do. do.	...	4·00	...	...	12·7	·30	·70	13·7	9·0	...	9 1 6
Do No. 5 ..	do	do. do.	...	7·50	...	...	7·0	·20	·40	7·6	13·25	...	11 9 0
Orchard Manure	do	do do.	...	2·00	...	...	14·0	·40	1·60	16·0	...	5·0	6 19 0
Special Mixture K	do.	do do.	...	8·34	...	...	8·4	·20	·40	9·0	...	10·04	10 1 6
Do K1 . do .	do do.	do do.	...	6·34	...	...	10·5	·20	·80	11·5	10·04	...	10 1 6
Tobacco Fertiliser ..	do . .	do do.	...	3·30*	...	...	14·0	·50	1·00	15·5	5·7	...	8 2 6
Potato Manure No 2 .	M.L. in diamond	do do.	...	3·75	...	...	14·5	·35	·75	15·6	4·5	...	7 16 6
Do No 4 ..	do. .	do do.	...	3·50	...	...	14·0	·30	·70	15·0	8·0	...	8 16 6
Do No 7 ..	do .	do do.	...	3·50	...	...	10·5	·20	·60	11·3	16·0	...	11 6 6
Do. No. 8 .	do .	do do.	...	4·00	...	...	12·7	·30	·70	13·7	9·0	...	9 1 6
Do No 5 .	do .	do do.	...	7·50	...	...	7·0	·20	·40	7·6	13·25	...	11 9 0
Orchard Manure .	do .	do do.	...	2·00	...	...	14·0	·40	1·60	16·0	...	5·0	6 19 0
Special Mixture K .	do .	do do.	...	8·34	...	...	8·4	·20	·40	9·0	...	10·04	10 1 6
Do F1 .	do .	do do.	...	6·34	...	...	10·5	·20	·80	11·5	10·04	...	10 1 6
Tobacco Fertiliser .	do .	do do.	...	3·30*	...	...	14·0	·50	1·00	15·5	5·7	...	8 2 6
Potato Manure B	C.S.M.L.	do do.	...	3·75	...	...	14·5	·35	·75	15·6	4·5	...	7 16 6
Do L	do	do do.	...	3·50	...	...	14·0	·30	·70	15·0	8·0	...	8 16 6
Do G	do	do do.		3·50			10·5	·20	·60	11·3	16·0		11 6 6
Do H	do	do do.		4·00			12·7	·30	·70	13·7	9·0		9 1 6
Do No. 5	do	do do.	...	7·50	...	...	7·0	·20	·40	7·6	13·25	...	11 9 0
Orchard Manure	do	do do.	...	2·00	...	...	14·0	·40	1·60	16·0	...	5·0	6 19 0
Special Mixture K	do	do do.		8·34	...	...	8·4	·20	·40	9·0	...	10·04	10 1 6
Do F1	do	do do.		6·34	...	..	10·5	·20	·80	11·5	10·04	...	10 1 6

| | | |

FERTILISERS—*continued.*

Name of Fertiliser.	Brand.	By whom Registered.	Nitrogen (N) as:				Phosphoric Acid (P_2O_5) as:				Potash (K_2O) as:		Price per ton on rails at Works or Perth.
			Nitrate.	Ammonia.	Blood & Bone.	Bone-dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total.	Sulphate.	Muriate.	
C.—MINERAL AND ORGANIC.			%	%	%	%	%	%	%	%	%	%	£ s. d.
Bone and Super	Sickle	Cuming Smith, Mt. Lyell F.F., Ltd.	...	...	...	2·0	13·0	·8	4·7	18·7	...	...	7 4 0
Do.	ML in diamond ...	do. do.	...	...	...	2·0	13·0	·8	4·7	18·7	...	...	7 4 0
Do.	C.S.M.L.	do. do.	...	...	...	2·0	13·0	·8	4·7	18·7	...	...	7 4 0
Do.	Swan	Binney & Son ...	...	...	...	1·37	8·0	...	9·65	17·65	...	...	6 0 0
Bone, Super and Potash ...	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	1·0	11·0	1·0	2·0	14·0	1·0	...	5 5 0
Potato Fertiliser (Bone Basis)	Swan	Binney & Son ...	...	...	...	3·0†	...	...	15·0	15·0	...	2·25	9 10 0
Do. Special ...	do.	do. ...	...	...	...	3·5†	14·0	...	1·0	15·0	...	8·0	9 5 0
Bone, Super and Potash ...	do.	do. ...	...	...	...	1·1	...	...	14·25	14·25	...	1·2	5 10 0
Orchard Fertiliser	do.	do. ...	...	...	...	3·17†	...	...	10·0	10·0	...	5·0	11 0 0
Potato Fertiliser X	do.	do. ...	...	...	...	3·20†	...	...	11·0	11·0	...	...	7 7 6
Domestic Garden No. 1 ...	Wondergrowth ...	W. J. Matthews ...	...	...	3·75†	...	12·0	·30	3·20	15·5	...	...	Sold in small lots only.

† Part as Ammonia.

APPLE EXPORT DURING YEAR, 1934.

GEO. W. WICKENS,
Chief State Supervising Officer.

Representatives of Fruitgrowers' Associations and Fruit Shipping Agents met at Sydney on the 16th, 17th, and 18th November, and strove in conference to find an effective and equitable method of limiting during 1934 the quantities of apples to be shipped to the United Kingdom and Continent of Europe.

The results following on last season's heavy export will still be fresh in the minds of growers. Fortunately, Western Australia was not hit quite so hard as the Eastern States, but all the same some consignments at the latter end of the season did not realise sufficient to cover costs, debits being incurred, and the whole season's output depended mainly for its profit on the rate of exchange.

Apparently the principal reason for low returns was a supply of apples greater than the market could absorb at prices payable to consignors, and the main objective of the meeting at Sydney referred to above was to take such steps as would prevent a similar undesirable experience occurring in 1934.

Australia's export figures during the past three years afford sufficient evidence that matters cannot be allowed to drift any longer, for those qualified to judge state definitely that 5,000,000 cases is the limit that the market can take in one season from Australia at remunerative prices, and the export figures disclose that without some control this quantity will be largely exceeded in the near future.

In 1931 Australia exported to the United Kingdom and the Continent of Europe 3,228,322 cases of apples, in 1932, 4,596,399, and in 1933, 5,563,000. Not only is the export increasing from those States which have in the past shipped regularly each year, but New South Wales and Queensland came definitely into the picture in 1933, and they (particularly New South Wales) are there to stay.

The methods of limitation decided upon were:—

1. Restriction of varieties;
2. Restriction of sizes;
3. Elimination of "plain" grade;

and to bring these into effect a list of names of apples for export, and the sizes, was agreed to, and the Department of Commerce was requested to issue a proclamation prohibiting the export to United Kingdom and the Continent of Europe of apples other than those named.

It will be seen from the list hereunder that the number of varieties still available for shipment reached the very respectable total of 42, and there is no doubt further reductions can, with advantage, be made when growers have worked over to better kinds those which are the least desirable, but although "42" are admittedly too many, this number is a distinct improvement on the "80" of last season.

Western Australian growers will note that all the main commercial varieties produced in this State are on the list, and that the limitation of varieties will not greatly affect us, though there are a few prohibited which used to go forward from here in small quantities, such as—"Commerce," "Ben Davis," Spitzenberg," "Shepherd's Perfection," "Rymer," "Springdale," "Strawberry Pippin," "White Winter Pearmain," and others.

The restriction of sizes will definitely cause a reduction in the quantity available for shipment, and to prevent much heartburning during the next export season it is trusted growers will see that their packers pack only such sizes as are shown on the following list, and that the brands on the cases are a true indication of the

contents. There is no doubt the inspectors will find 3-inch "Cleopatras" being submitted and branded as 2¾ inches; 3¼-inch "Dunn's" branded as 3 inches; and 2-inch of other varieties branded as 2¼ inches, and it must be definitely understood that these wrongly branded cases cannot, as in the past, be corrected on the wharf and sent forward on consignment. A permit to ship will not be granted, and not only will the fruit be shut out but the grower will also be liable for dead freight on the boat if such has been booked on his behalf.

Western Australia has, in the past, only shipped a small percentage of "Plain" grade apples, but in 1934 none will be allowed to go forward, and it behoves all packers to keep prominently in their minds the fact that in "Standard" grade the allowance for blemish is only 10 per cent.

The names of apples and their sizes referred to above are as follow:—

APPLE AND PEAR EXPORT COUNCIL CONFERENCE.

Varieties recommended for Export, 1934.

Dessert Apples.

Australian Beauty	2¼ inches	to	2¾ inches
Aromatic	2¼ „		2¾ „
Cleopatra	2¼ „		2¾ „
Cox's Orange Pippin	2 „		2¾ „
Crofton	2 „		2¾ „
Delicious	2¼ „		2¾ „
Dougherty	2¼ „		2¾ „
Gravenstein	2¼ „		2¾ „
Geeveston Fanny	2¼ „		2¾ „
Jonathan	2 „		2¾ „
King David	2¼ „		2¾ „
Lalla	2¼ „		2¾ „
New Town Pippin	2¼ „		2¾ „
Pomme de Niege	2 „		2¾ „
Ribston Pippin	2¼ „		2¾ „
Scarlets	2¼ „		2¾ „
Shoreland Queen	2¼ „		2¾ „
Statesman	2¼ „		2¾ „
Worcester Pearmain	2 „		2¾ „
Yates	2 „		2¾ „
King Pippin	2¼ „		2¾ „
Rokewood	2¼ „		2¾ „
Sturmer	2¼ „		2¾ „
Stone Pippin	2¼ „		2¾ „

Culinary.

Alfriston	2½ „		3¼ „
French Crab	2½ „		3 „
London Pippin	2½ „		3 „
Mobb's Codlin	2½ „		3 „
Prince Alfred	3 „		3¼ „
Reinette de Canada	2½ „		3 „
Stewart's	2½ „		3 „
Schroeder	2½ „		3 „

Dual Purpose.

Alexander	2¼ inches	to 3	inches
Crow's Egg	2¼ „	3	„
Democrat	2¼ „	3¼	„
Duke of Clarence	2¼ „	3	„
Dunn's	2¼ „	3	„
Granny Smith	2¼ „	3	„
Rome Beauty	2¼ „	3	„
Red Rome	2¼ „	3	„
Tasman's Pride	2¼ „	3	„
Nickajack	2¼ „	3	„

THE SAN JOSE SCALE.

Aspidiotus perniciosus (Comstock).

L. J. Newman, F.R.E.S.
Government Entomologist.

The original home of the San Jose Scale (pronounced San Ho say) is China.

It was first recorded as a serious deciduous fruit tree pest in the State of California in the year 1873. Since that time it has been spread to various parts of the world and is now regarded as one of the worst scale insects of deciduous fruits.

Fortunately, the scale was early recognised in this State as a potential danger to the fruit industry. To prevent this, a system of compulsory winter spraying was instituted, which has been successful in keeping the pest within bounds. All areas are not infested. All parts of a tree above ground, including the fruit, are subject to attack.

To further control the spread of this scale, nurserymen are compelled under the Plant Diseases Act to fumigate all fruit trees and other plants with Hydrocyanic Acid Gas.

It has been definitely demonstrated that thorough winter spraying will control San Jose Scale.

There have admittedly been economic factors which have been against the fruit grower, and this may have a tendency to create a slackness in orchard sanitation. This tendency should be checked, as any neglect in this regard will very soon be reflected in the deterioration of the trees and the rapid increase of insect pests. Under conditions of neglect, the San Jose Scale rapidly increases.

In view of the regulations now in force in many countries against the introduction of this scale, there is urgent need for all orchardists to realise the necessity of making every effort to control and, if possible, eradicate this scale. Any fruit found infested with San Jose Scale is rejected as unfit for export.

Before proceeding to deal specifically with the San Jose Scale, let us see just what sort of an insect a scale is, and why it is called such. In what manner, for instance, do they differ from flies and other insects.

In making these peculiar creatures, nature seems to have cut one of her most perplexing antics. Scales we shall see differ from other insects in several ways.

In the first place, the adult male only is provided with a pair of wings. At this stage of his life, the male has no functioning mouth parts and consequently lives only for a very short time.

The female scale never develops wings, but does at all stages possess functioning mouth parts.

When first born, both sexes are equally active and provided with mouth parts. In the short lived active larval stage, they crawl about in search of a desirable place on the host plant to locate themselves.

Many species when once they settle down never move about again during their lives, while others are capable of locomotion until partly full grown and some all their lifetime.

Amongst scale insects there are great differences in appearance and habits. Some like the Mealy Bugs (*Dactylopinae*) secrete a covering composed of a cottony material. Others like the Lecaniums (Black Scale, etc.) secrete a waxy continuous layer, which forms their protection. One group found in Australia forms hard galls of various shapes on the trees. Another group form Hard or Armoured Scales (*Diaspinae*), and includes the San Jose Scale, Red Scale, Mussel Scale, etc. The scale whatever its nature, is only the covering, the true insects being beneath.

Scales are closely related to the Aphidae, both belonging to the order Hemiptera. They are also known as Haustellate insects, that is, their mouth parts are formed for sucking plant juices and not chewing as in the Mandibulate insects, Caterpillars, Beetles, etc.

It has been estimated that there are over 300 species of scales found in Australia. Naturally those that have up to date caused most trouble are the introduced. No native scale at present found here is known as a serious orchard pest. If we take and enumerate the scales found in our orchards and gardens, we will not find any native species. Some of our native species have been introduced into other countries and proved most serious pests. This is the natural result following on the unbalancing of nature. The host scale has been introduced without its natural enemies. The time may come, however, when some of our native scales may become troublesome, owing to the failure of their native food plants, and thus forcing them to seek fresh food plants for sustenance or die out. Nature is very persistent in this respect, and strongly objects to the elimination of any species whether animal or vegetable.

Although present probably throughout the entire temperate and tropical regions, scales attain their highest individual and numerical development in the latter.

It is beyond the scope of this article to allude to, much less describe, the difficult sub families and sections into which this important family of insects is divided. The ordinary observer will have no difficulty in concluding that a Mealy Bug or a Cottony Cushion Scale is an insect, for he will readily detect its six legs and the action of these as it crawls about. It will not, however, be equally clear that the round or oval fixed scales, which have lost their legs, and do not move again, once they have formed their scale, are just as truly insects and members of the same family. This remarkable difference that obtains between members of the same order and family, is accounted for by the fact, that the female insect does not go beyond the larviform condition (exemplified in other insects by the caterpillar or grub stage), whereas in other members of the same family they early exchange to the pupiform, shedding their eyes, legs and other appendages, merely becoming egg masses.

If by the aid of the point of a needle or penknife the scale is raised, a mass of minute particles will be observed which, under a magnifier, will prove to be so many tiny eggs, or in the case of the San Jose Scale the body of the

mother will be found literally packed with young. As many as 1,500 eggs have been counted, from a single Lecanium. Some scales produce many generations each season, others like the Vine Scale (*Lecanium cymbiform*) and other lecaniums have but one brood.

All scale insects are not oviparous or egg layers, although the majority appear to be. In the case of certain species they are viviparous, that is the progeny are born alive. Amongst the viviparous scales there are locally the Soft Brown (*Lecanium hesperidum*) Red Scale (*Chrysomphalus aurantii*), the San Jose Scale (*Aspidiotus perniciosus*) and others. The young of scales when born or hatched will be found on observation to exhibit marked activity. This free life manifested by the scale insect at a period of its existence when it is still very small, is the explanation of its apparent spontaneous increase upon plants, whereon its presence had previously escaped observation.

Persistent activity throughout life is not, however, a character possessed only by the Mealy Bugs, but is to a degree found to exist among the soft bodied scales (*Lecanidae*), up to that period when the adult female is distended with eggs or young. Locomotion upon the food plant after this period ceases.

The Hard Scales (*Diaspinae*), which include the San Jose scale and others have no power of movement on the plant once the larva settles. The beak is inserted and a scale covering formed. The duration of the active life of members of this sub-family is limited to a few hours or days following its birth, during which it takes no food.

The mouth parts of scales are formed for sucking and are very long, often exceeding in length the body itself. This hairlike organ or probosis is held deeply fixed in the tissue of the plant, and remains so during the entire stationary existence, forming a tube through which the plant sap is imbibed. The mouth is also the medium by which the scale establishes the injurious relationship to the plant, that is of such importance to those interested in their successful culture.

This proves in a general way that a scale is a true insect, which is revealed while in the young larval stages of all species, and in some throughout life, and again with others by the structure of the winged male. The female has apparently become degraded, and possesses little else than the powers of destructive feeding, and reproduction.

A single individual of this interesting group of insects, namely the San Jose Scale (*Aspidiotus perniciosus*), will now be considered.

ORIGINAL HOME.

Every country in which this scale is found repudiates the honour of being the native and original home of this pest. Indirect evidence, however, points to China as the probable native place, it being introduced into other countries many years ago per medium of imported trees, plants and fruits. This goes to prove the necessity of the rigid quarantine laws now in force, and to which some people bitterly object.

It first received its specific name at the hands of the entomologist, Comstock, in 1880 who assigned to it the very appropriate name "perniciosus," meaning highly destructive.

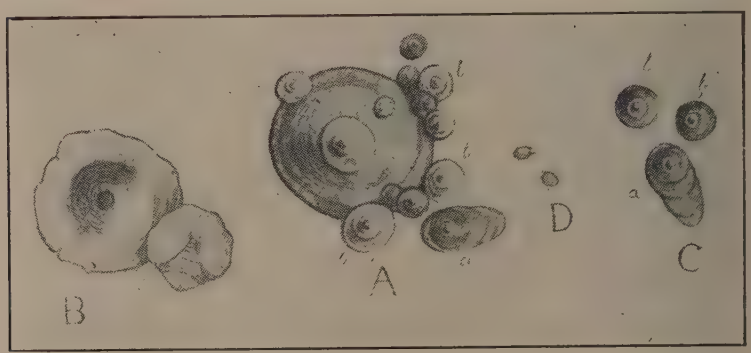
LIFE HISTORY OF SCALE.

From observations made, the following has been noted. The young or larvae are born alive, the eggs hatching within the body of the mother. They are very minute lemon coloured, active creatures. Each larva is furnished with two

feelers or antennae, a long hairlike mouth and six strong legs. When the young has found a suitable place on the plant to settle, it inserts its rostrum or beak through the bark into the juicy sap cells beneath, and draws on same for its sustenance.

Portion of apple branch with San Jose Scale, natural size.

A waxy secretion from the outer parts of its body combined with its cast skins soon forms a covering known as the scale under which the true insect lives. Instead now of the lemon coloured larva we see a greyish slaty coloured object. Even at this young stage the central nipple is generally quite prominent, though sometimes it appears to be wanting altogether. As the insect becomes more mature, the scale becomes darker, and the nipple when exposed slightly golden. Twelve days from birth, the larva has its first moult, and with this casting of the skin the female loses her eyes, feelers and legs, while the male loses his legs and feelers.



A, Adult female scale with immature young of various stages. B, Adult female turned over, revealing the insect beneath, with bristle-like mouth parts exposed. C, Adult male scale. D, Young active larvæ. (Miss A. Hearle.)

The female scale becomes circular and flat and at this period is slightly smaller than the male, whose scale has assumed an oval form. The male of all the circular Aspidiotus scales can always be determined by the oval form. About

seven days after the first moult the male again casts his skin and appears with dark purple eyes and feelers and legs renewed. Two days after the male second moult, the female goes through the same process. At 23 days from birth the male has his third and final moult. Three to five days later, or 26 to 28 days from birth the adult winged male appears.

This issue of the male has been frequently observed by the writer, and is accomplished by the insect backing out from the rear end of the scale. The perfect adult male has two wings, prominent and beautiful antennae, conspicuous purple eyes and anal style, but lacks any mouth parts. He is in fact a most conceited dude, and for this reason we need not be surprised at the lack of anything, even brains. He lives a short and merry life, but owing to the lack of a mouth, misses many of the greatest pleasures in life. He has not even the joy of beholding his own progeny, as he dies before they are born. It may be as well for the family, that they never knew their father as they could not possibly take any pride in their shallow pated parent. To return to the female which is the one we have to fight, and which was left after her second moult. At 31 to 34 days from birth she has her final and adult moult, and seven days later gives birth to living young. Thus we have a life history of four weeks in the case of the male, and roughly five weeks in the case of the female. The male as before stated, only lives a few days after reaching maturity, whereas the female lives and reproduces for several weeks.

The mature females are very prolific, and according to Dr. Howard, of America, the average producing period of a female is six weeks, and the average number of young 400, or 10 every 24 hours. There are at least five generations of this scale per annum.

Infested pear showing typical discolouration and injury to fruit. (Original.)

GENERAL HABITS.

The arrangement or grouping of the San Jose Scale on the bark is often quite characteristic, and is frequently sufficient to fix their identity. In slight infestations they seldom have a tendency to cluster, but are scattered somewhat

evenly on the bark. In badly infested orchards the presence of the scale on new growths, and fruit produces a deep purplish-red colouration in the tissue under the epidermis.

When the scale is bad it is not an uncommon thing to see the scales overlapping one another. Bark that is thickly infested has a grey ashy appearance, due to the presence of the large number of scales, and becomes rough and cracked. It can be proved whether the scale is alive by crushing with a knife or the finger nail. If a yellow oily substance exudes, they are alive, but if no such oily liquid appears after pressure they are dead.

HOW THE PEST SPREADS.

In the first place it is introduced into orchards primarily per medium of young stock, cuttings and scions. Birds and insects have been proved spreaders of this pest. When they alight upon an infested tree the young active larvae crawl on to their bodies and are thus carried about. Man himself may be an agent in its distribution, when picking and working amongst the infested trees; the young fall or crawl onto his clothes, tools, utensils, etc., and are thus conveyed about. Infestation from tree to tree is often accomplished by the blowing about of the tiny larvae. It has been noted that the scale will spread in the line of the prevailing winds. Infested fruit, packed and sold about the country is a possible means of spreading the scale. Growers need to be most particular in this regard, especially when dealing with export fruits, lest a prejudice be created in the minds of importers in other countries against our entire crop, from the fact that it would be branded as coming from an infected country. In fact, many countries have already declared an embargo against the introduction of fruit and plants found to carry this scale.

CLIMATIC CONDITIONS.

As a factor in the spread and increase of this pest, it has been observed for some time that there must be other conditions than mere food supply, to determine the abundance of scale insects in any particular region. As mentioned earlier, this scale has not proved to be as serious a pest in this State as it has in other countries, for which we need to be thankful. It is possible, even probable, that differences in the amount of humidity are of greater importance than extreme temperatures. It is thought, however, the most likely local climatic factor is the period of dryness, with intense summer heat periods, which occurs during most local summers. The same conditions of hot dry winds have a similar effect on the Woolly Aphis. There are no known specialised natural enemies in this State which concentrate upon it.

A casual internal chalcid wasp is bred out under cage conditions, and several species of ladybirds have been noted feeding upon it. Although it has been proved not to be so serious a pest here, it must not be permitted to escape from control, as we do not know what a season may bring forth with regard to insect pests.

METHODS OF TREATMENT.

Extermination, when once the pest has got a start in an orchard, appears to be well nigh impossible, although there are local records of its having been wiped out when taken in time, but, generally speaking, this is not so.

While, therefore, one is undoubtedly justified in asserting that the San Jose Scale is to be a permanency, it by no means follows that the profitable growth of deciduous fruits is seriously menaced on this account. Experience here and in other countries has abundantly demonstrated that this scale insect can be controlled.

In other words, by proper treatment, the value of which has been demonstrated by much practical experience, an orchard may be protected from serious injury and kept in a good paying condition so far as influenced by the San Jose Scale.

There are several methods of control which no attempt will be made to describe here, but this article will be confined to the standard formula as now recommended by the Department.

All deciduous trees throughout the orchard must be thoroughly sprayed while the trees are dormant before the 7th September with one of the following:—

1. A registered brand of Commercial Lime Sulphur Wash, at a strength of 1 gallon of stock to 7 gallons of water; or

2. A registered brand of Prepared Spraying Oil, used at a strength of 1 gallon of spraying oil in 19 gallons of water.

When an orchard has become badly infested with San Jose Scale, two dormant period sprayings are recommended, the first spraying to be completed before the 30th June, the second before the 7th September.

If the Red or Bryobia Mite is also present, Prepared Spraying Oil should be used first and the Lime and Sulphur second. There should be at least one month interval between the application of either of these sprays.

Both sprays at the strengths here advised are for use only on deciduous trees, during dormancy.

It has been proved that the scale in this State can be effectively controlled by one good regular thorough winter application. The lime sulphur spray kills the scale not only by direct caustic action, but also by leaving a limy coating on the trees, which remains for a long time and thereby protects the trees against any young that may issue from adults which escaped the winter action. The spray before application should be passed through a strainer and the pump must be provided with an effective agitator.

In applying lime sulphur spray to some varieties of apples, it has been noted that the hairy nature of the terminal growths, prevents the wash from properly coating the bark. Scales which are situated on this terminal wood, are not always destroyed owing to the hairy protection. The young from these naturally crawl upwards on to the new wood, which has no lime sulphur coating, or in the case of spurs, on to the fruit, so that trees on which the scale has been pretty thoroughly exterminated, may nevertheless present badly spotted fruit. In cases like that it would be wise to spray the terminals with the oil spray.

The wear on pumps and nozzles can be kept to a minimum by carefully washing the apparatus promptly after use. When spraying with the Lime Sulphur wear only the oldest clothing, and take care to protect the hands, face and eyes, and thus avoid injury to the skin and unnecessary inflammation of the eyes.

In addition to its usefulness against insect pests, Lime Sulphur has proved to be a valuable fungicide.

In conjunction with spraying, orchard culture and sanitation must be practised. Neglected, non pruned, and starving or weak trees are always more susceptible to this scale than those which are healthy and well kept. Trees which are debilitated from any cause whatever, rapidly fail, when brought under the influence of this scale.

Points to remember about spraying for San Jose Scale:—

1. Do not spray when the trees are wet. This weakens the wash.
2. Do not spray just before rain, because the rain will rapidly wash the mixture off before it has time to dry.
3. See that the spraying is done during the dormant period.
4. Test the strength of the Lime Sulphur. If 32 degrees Beaumè, use at 1 in 7 of water; if 28 degrees Beaumè, use 1 in 6 of water.
5. Take advantage of wind, when spraying large trees.
6. Do not skimp the amount of spray. Cover every inch of tree.
7. If trees have hairy tips, it is a good plan to apply the prepared Oil Spray to these parts.
8. Keep spray machine in good repair.
9. Use gloves to save the hands and goggles for the protection of the eyes.
10. Never use Lime and Sulphur wash and Oil sprays together. Allow at least one month interval between the treatments.

PEA WEEVIL (BRUCHUS PISORUM).

Warning.

L. J. Newman, F.R.E.S.,
Government Entomologist.

In visiting various centres in the South-West during October, there was ample evidence of the presence of this pest in the field pea crops.

The eggs, which are oval, yellow bodies, are glued to the exterior of the young pea pods. They are generally deposited singly. As many as 28 eggs were counted on a single pea pod. These eggs are easily observed by the naked eye. Fortunately this pest can be controlled by fumigation, but unless those concerned take a co-operative interest in the work of suppressing this weevil, considerable losses will follow and the pest will become more widespread.

With the object of preventing the spread of this pest per the sale of infested seed, the following Order in Council was gazetted on the 28th. April, 1933. This places the onus on the seller of the seed to see that the conditions, as set out in the Order, are carried out. For fuller details *re* life history and treatment, see Leaflet 357.

(*Extract from Government Gazette of 28th April*, 1933.)

AT a meeting of the Executive Council held in the Executive Council Chambers, at Perth, on the 21st day of April, 1933, the following Orders in Council were authorised to be issued:—

Plant Diseases Act, 1914.

ORDER IN COUNCIL.

WHEREAS it is enacted by Section 35 of "The Plant Diseases Act, 1914," that the Governor may make Regulations prescribing all matters which by this Act are required or permitted to be prescribed, or which it may be necessary or convenient to prescribe for giving effect to this Act, and, *inter alia*, prescribing the manner in which plants, fruits, and coverings in which plants and fruits have been contained or packed shall (whether infected or not) be treated in order to eradicate disease or to lessen the risk of the spread of the disease: And whereas certain Regulations were made under the said Act and published in the *Government Gazette* on the 16th day of September, 1921: And

whereas the disease known as Pea Weevil (*Bruchus pisorum*) is existing in Western Australia, and it is now deemed expedient to amend the said Regulations in the manner hereinafter mentioned, in order to prescribe the manner in which field peas produced in or imported into this State shall be treated in order to eradicate the said disease and to lessen the risk of the spread of the said disease: Now, therefore, His Excellency the Lieut.-Governor and Administrator, acting with the advice and consent of the Executive Council and in exercise of the power conferred by the said Act, doth hereby amend the Regulations made under the said Act and published in the *Government Gazette* on the 16th day of September, 1921, by inserting after Regulation 48A a new Regulation as follows:—

48B. No person shall sell, supply, distribute, deliver, or dispose of any field peas (whether produced within or imported into Western Australia) to any other person unless and until such field peas have been fumigated with carbon-bi-sulphide in such manner as effectively to render the same free from the disease of Pea Weevil (*Bruchus pisorum*).

(Sgd.) L. E. SHAPCOTT,
Clerk of the Executive Council.

WEST ARTHUR PASTURE COMPETITION, 1933.

H. G. ELLIOTT,
Agricultural Adviser, Dairy Branch.

The Pasture Competition, 1933, was organised by the West Arthur and District Agricultural Society for the best five acres of pasture exhibited. Judging was carried out from October 24th to 27th by the writer, the results being as follows:—

Competitor.	District.	Yield. 45	Freedom from Weeds. 15	Variety of Useful Grasses. 15	Freedom from Diseases and Insect Pests. 15	Evenness of Growth. 10	Total. 100
J. D. & C. Johnston, "B"	Bokal ...	37	15	13	15	8	88
J. Hatherly	Arthur River	38	13	13	13	10	87
R. Schinzig	Duranillin ...	44	14	5	12	9	84
E. Loynel, "B" ...	Sewell ...	43	13	3	15	9	83
K. Cooling	Duranillin ...	43	14	2	13	9	81
Mrs. Cameron, "B" ...	Collie ...	39	15	4	14	8	80
E. Loynel, "A" ...	Sewell ...	43	11	4	11	7	76
W. Kelliher	Darkan ...	38	12	5	10	9	74
Mrs. Cameron, "A" ...	Collie ...	28	12	4	13	8	65
W. Nicholls	Arthur River	28	13	5	11	7	64
J. D. & C. Johnston, "A"	Bokal ...	29	9	5	11	8	62
T. H. James	Sewell ...	28	10	3	12	6	59
H. Harrison	Bokal ...	24	10	4	11	7	56
F. B. Horwood ...	Darkan ...	21	11	5	13	3	53

The rainfalls as recorded during the year at the centres concerned were:—

Centre.	April.	May.	June.	July.	August.	Sept.	October.	Total for Growing Period.
								inches.
Duranillin ...	54	317	444	212	371	169	208	1,775
Collie ...	134	367	1,121	594	416	441	468	3,541
Darkan ...	67	263	424	254	338	199	199	1,744

Messrs. J. D. & C. Johnston's winning entry consisted of Subterranean Clover and Wimmera Rye Grass, planted at the rate of 6 lbs. each per acre on new land, the fertiliser applied being one bag of superphosphate per acre. The land was free from all insect pests and diseases, and also free from weeds with the exception of an odd plant of Yellow Weed (*Bartsia viscosa*). The plot was calculated to yield 11.1 tons of green fodder per acre.

Mr. J. Hatherly's pasture also consisted of Wimmera Rye Grass and Subterranean Clover, planted on a granitic wash soil following on a tobacco crop which received a half ton of fertiliser per acre. The seeding was 10 lbs. Wimmera Rye Grass and 3 lbs. of Subterranean Clover per acre, the fertiliser applied being 90 lbs. superphosphate. Red Mite was the only insect pest, with Prickly Lettuce, Thistle, and Yellow Weed (*Ba tsia sp.*) as weed pests. This pasture was calculated to yield 11.75 tons of green material per acre.

The pasture entered by Mr. R. Schinzig was established during 1926 on land which originally was timbered with White Gum, Jam, Blackboy, and Stinkwood. The pasture was one of Subterranean Clover, with a heavy growth of minor annual grasses such as Brome Grass, Silver Grass Soft Brome, Barley Grass with some Woolly, Suckling, and Hop Clover incorporated.

The weeds consisted of Cape Weed, Flat Weed, and *Bartsia viscosa*.

Insect pests—Clover Weevil and Red Mite.

The area was topdressed with 90 lbs. superphosphate per acre in the autumn.

The pasture was grazed until the end of August, and was calculated to yield about 12.8 tons per acre.

E. Loynel "B."—The pasture entered by Mr. Loynel was dominantly Drooping Flolwered Clover, grown on White Gum—Blackboy flats. The chief plants incorporated in the Drooping Flowered Clover was Subterranean Clover, Suckling Clover, Soft Brome, Silvery Grass, and Brome Grass.

There was no evidence of any insect pests.

The weeds consisted of Cape Weed, with odd plants of *Bartsia*.

The area was topdressed annually with one bag of superphosphate per acre in the autumn.

This pasture was grazed heavily until the end of August, and was calculated to yield about 12.4 tons of green material per acre.

A number of the remaining plots were of high standard, consisting mainly of Subterranean and Drooping Flowered Clovers. The principal grasses were those of the minor types, such as Spear Grass, Brome Grass, Soft Brome, Silver Grass, Barley Grass, etc.

The chief insect pests were Red Mite, Clover Weevil, and in one field only was Lucerne Flea present.

With regard to the weeds, *Bartsia viscosa*, Cape Weed, Flat Weed, and Wild Pink were the most prevalent.

The highest yielding crop was that of R. Schinzig, which was estimated to yield about 12.8 tons of green material per acre.

The lack of efficient renovation of the pastures with pasture or chain harrows was noticeable on nearly all the fields judged; this, together with irregular topdressing, accounted for the general unevenness in growth.

All competitors topdress their pastures annually, or, in some cases, during the autumn and spring, with superphosphate, at rates varying from 45 lbs. to 2 cwts. per acre per annum.

WEST ARTHUR DAIRY HERD COMPETITION, 1933.

H. G. Elliott,
Agricultural Adviser, Dairy Branch.

The inspection of the dairy herds entered in the West Arthur Dairy Herd Competition, 1933, was made on 24th to 27th October, and awards were made as follows:—

Competitors.	District.	General Condition of Herd.	Dairy Type and Breeding.	Bull Pedigree and Dairy Type.	Heifers and Calves—Condition and Quality.	Sanitation.			Total.
						Milking Shed.	Dairy.	Milking Utensils.	
		30	25	10	15	10	5	5	100
E. Loynel ...	Bowelling	25	21	10	14	8	4	4	86
H. Harrison	Bokal ...	24	19	10	13	6	4	3	79
A. Holmes ...	Duranillin	25	23	9	14	2	2	3	78
T. H. James	Sewell ...	24	21	9	13	5	2	3	77
R. Schinzig...	Duranillin	21	20	9	13	2	2	4	71
J. T. Quill ...	Duranillin	21	19	9	13	2	2	3	69
W Kelliher...	Darkan ...	22g	22g	...	12	5	3	3	67

g No bull; points added to these sections.

Mr. E. Loynel's winning herd consisted of 30 cows, which are being graded up to Jerseys; one pure bred Jersey bull, from Mr. S. P. Herbert's "Nooka" stud at Nungarin; nine excellent grade Jersey heifers, and 20 Jersey calves. All stock were in good condition, and were grazing on good Subterranean and Drooping Flowered Clover pastures. Mr. Loynel conserves large quantities of meadow and oaten hay, and uses dicalcic phosphatic licks during the periods when the pastures are dry.

The milking shed is of the "walk through" type, with concrete floors and has a milking machine installed. The dairy is well ventilated with fly-proof wire doors and windows, also having a good concrete floor.

GENERAL.

The herds judged were found to be in excellent condition and, on most farms, uniformity in type was in distinct evidence. With the exception of one herd, with a Guernsey herd sire, all owners are "grading up" to Jerseys. Pure bred bulls are in use on all farms.

All herds were grazing on good pastures of the annual winter and spring type, consisting mainly of Subterranean Clover or Drooping Flowered Clover, with other annual types of clovers and minor grasses.

TWO PLANTS SUSPECTED OF BEING POISONOUS TO STOCK.

C. A. Gardner,
Government Botanist.

Losses in stock from coastal areas have frequently been reported, and in some cases have been attributed to poisoning. In this connection suspicion rests upon two plants concerning which there is some evidence to show that at least in certain seasons they are undoubtedly to a greater or less extent toxic. Both plants belong to the genus *Anthocercis*, a genus belonging to the family Solanaceae, which contains other local poison plants, such as Native Tobacco and Pituri.

The genus *Anthocercis* is represented in Western Australia by twelve species, and although Baron von Mueller, a former Government Botanist of Victoria, stated that all are poisonous, this is questionable. At least one species (*A. anisantha*), a loose-growing shrub with white flowers, found around granite rocks in the Eastern districts, is often eaten readily by stock in periods of drought.

In the early years of settlement in Western Australia, a large white-flowered species of Anthocercis (*A. viscosa*) which inhabits the granite rocks of the South coast, was reported as a poison plant in the Albany district. Cattle died from eating it, and following several losses within the townsite area the plant was eradicated. A few shrubs may still be seen on the summit of the hill occupied by the Fort. The plant also occurs on Dempster Head, Esperance, and at various intermediate places, but always associated with granites. The large roundish viscid or gummy leaves, and the large white fragrant flowers make it a readily recognisable species.

The second species is of much wider range. *Anthocercis littorea* extends throughout the littoral tract between the Murchison River and Point Malcolm, near Israelite Bay. It is most common on the limestone sands, and may be seen abundantly between Rockingham and the Hill River, and again on the South coast. It is fairly prevalent to the immediate South of Mount Ragged, on the Balladonia-Point Malcolm track, and in the Geraldton district. This shrub, which is semi-herbaceous, has variously-shaped thick and almost fleshy leaves, usually some short prickles on the stems, and yellow rayed flowers streaked with violet lines in the tube of the flower. Dr. A. Morrison when Government Botanist reported this plant as causing the poisoning of some children in 1899, the symptoms observed resembling those produced by Belladonna, and Turner ("Supposed poisonous plants of West Australia"—Australasian Association for the Advancement of Science vii., 912 (1898) lists this species, together with *A. viscosa*, as poison plants.

To what extent *A. littorea* affects stock on coastal country is yet to be determined. It is probable that the plant is not equally virulent throughout the year, and the matter is one requiring investigation. Until this is done stockmen running sheep and cattle on coastal country would profit by observations upon this plant with a view to its potentialities as a toxic species, and report any such observations.

The accompanying plate gives details of leaf and flower.

EXPLANATION OF PLATE.

Anthocercis littorea Labill.

A. habit. B. leaf. C. & D. flower (slightly enlarged). E. stamens and pistil. F. branch with fruits. A. B. & F. reduced to half size. Icon. origin. King's Park, Perth, W.A.

THE VALUE OF HOME-GROWN FOODSTUFFS TO DAIRYMEN.

L. C. Snook, B.Sc. (Agric.),
Agricultural Adviser, Dairy Branch.

Dairy farmers are quite familiar with the advice that all food materials required should be produced on the farm. It is generally recognised that this advice is sound, but advocates of "home production" are often handicapped because they cannot give definite evidence of the value in £ s. d. of commonly unsaleable products such as meadow hay, silage or green maize. When a farmer maintains as many do—that it does not pay him to grow maize or conserve meadow hay, the best method of conversion is to show how much money will have to be spent to buy the equivalent nutrients in the form of chaff or concentrates. Farmers rarely realise the value of home grown roughages, and the production of these would be greatly stimulated if their true worth were known.

In Table I. will be found a number of alternative daily rations all supplying sufficient nutrients for an average dairy cow (about 800 lb. live weight) producing two gallons of 5 per cent. milk per day. For the sake of simplicity no allowance is made for any food received in grazing—the value of pasture varies considerably. Ration 1 consisting of chaff and bran is used as a standard. A suburban dairyman whose cows received no grazing would have to expend nearly 1s. 2d. on these ingredients to maintain the cow in condition and keep the production up to two gallons. In the succeeding rations, home grown roughages are introduced, and the value of these is determined by a method of substitution. For example, ration 1, costing about 1s. 2d. can be replaced by ration 2 which consists of 24 lb. of meadow hay and 3.3 pence worth of bran. It follows that this meadow hay cannot be worth more than 10½d. or else it would be cheaper to buy chaff. Conversely it is more profitable to use meadow hay than buy chaff so long as it does not cost more than 10½d. per 24 lb. (£4 2s. 4d. per ton) to conserve. In other words, a ton of meadow hay will save an outlay of £4 2s. 4d. spent on chaff. The ability to assess the value of the produce of his labour in definite monetary terms often proves of distinct encouragement to the farmer. In a similar fashion the relative worth of other materials has been computed.

Table 1.—ALTERNATIVE RATIONS.

Supplying full Daily Requirements of a Cow of 800lbs. liveweight, Producing two gallons of 5 per cent. Milk per day.

Foodstuff.	lbs. of Food-stuff.	Dry Matter.	Starch Equiv-alent.	Digest-ible Crude Protein.	Value if Pur-chased.	Cost of Purchased Material.
	lbs.	lbs.	lbs.	lbs.	pence.	pence.
Requirements	—	18·25	10·90	1·88	—	—
1.—Chaff (good)	20	17·6	7·20	0·84	8·60	8·60
Wheat Bran	8	7·0	3·84	1·04	5·28	5·28
	...	24·6	11·04	1·88	13·88	13·88
2.—Meadow Hay (good mixed)...	24	21·1	8·40	1·27	10·58	...
Bran	5	4·4	2·40	0·65	3·30	3·30
	...	25·5	10·80	1·92	13·88	3·30

Supplying full Daily Requirements of a Cow of 800lbs. liveweight, Producing two gallons of 5 per cent. Milk per day.

Foodstuff.	lbs. of Food-stuff.	Dry Matter.	Starch Equiv-alent.	Digest-ible Crude Protein.	Value if Pur-chased.	Cost of Purchased Material.
	lbs.	lbs.	lbs.	lbs.	pence.	pence.
3.—Meadow Hay (good mixed)	20	17·6	7·00	1·08	8·82	...
Oaten Grain	2½	2·2	1·55	0·17	1·33	1·33
Wheat Bran	5	4·4	2·40	0·65	3·30	3·30
	...	24·2	10·95	1·90	13·45	4·63
4.—Meadow Hay (good mixed)...	20	17·6	7·00	1·08	8·82	...
Bran	5	4·4	2·40	0·65	3·30	3·30
Crushed Wheat	2	1·8	1·46	0·18	1·20	1·20
	...	23·8	10·86	1·91	13·32	4·50
5.—Chaff	20	17·6	7·20	0·84	8·60	...
Bran	2	1·8	0·96	0·26	1·32	1·32
Wheat (crushed)	2	1·8	1·46	0·18	1·20	1·20
Linseed Meal	2	1·7	1·40	0·52	3·48	3·48
	...	22·9	11·02	1·80	14·60	6·00
6.—Chaff	20	17·6	7·20	0·84	8·60	...
Crushed Wheat	4	3·5	2·92	0·36	2·40	2·40
Meat Meal	1	0·9	·90	0·60	1·86	1·86
	...	22·0	11·02	1·80	12·86	4·26
7.—Meadow May (good mixed)...	12	10·6	4·20	0·65	5·29	...
Maize (green)	25	5·5	3·12	0·28	3·64	...
Bran	7½	6·6	3·60	0·98	4·95	4·95
	...	22·7	10·92	1·91	13·88	4·95
8.—Clover Hay	18	15·8	6·84	1·62	9·21	...
Maize (green)	32	7·0	4·00	0·35	4·67	...
	...	22·8	10·84	1·97	13·88	*Nil*
9.—Maize (green)	32	7·0	4·00	0·35	4·67	...
Lucerne (bud stage) ...	20	4·0	2·08	0·76	3·04	...
Meadow Hay (mixed) ...	14	12·3	4·90	0·77	6·17	...
	...	23·3	10·98	1·88	13·88	*Nil*
10.—Chaff	25	22·0	9·00	1·05	10·75	...
Lucerne (bud stage) ...	20	4·0	2·08	0·76	3·13	...
	...	26·0	11·08	1·81	13·88	*Nil*
11.—Sudan Grass, 2ft. high (grazed)	50	11·0	6·00	1·45	8·52	...
Chaff	10	8·8	3·60	0·42	4·30	(4·30)
Oats	2	1·8	1·24	0·14	1·06	1·06
	...	21·6	10·84	2·01	13·88	1·06
12.—Silage (mixed cereal and legume)	30	7·5	3·00	0·63	4·45	...
Meadow Hay	16	14·1	5·60	0·86	7·05	...
Bran	2	1·8	0·96	0·26	1·32	1·32
Oats	2	1·8	1·24	0·14	1·06	1·06
	...	25·2	10·80	1·89	13·88	2·38

The cost of purchased foodstuffs varies according to time and place. The values used in preparing the above Table are given in Table II. It may be necessary to adjust these somewhat to coincide with local conditions. For instance, freight on bran is an important factor and, again, wheat is not worth 3s. per bushel to the Wheat Belt farmer, hence this commodity is worth relatively more to him as a stock food than one would infer from the Tables.

TABLE II.

COST OF PURCHASED FOODSTUFFS.

Foodstuff.	Cost Used.	Cost per lb. pence.
Chaff	£4 per ton	0·43
Bran	£5 10s. per ton (short) ...	0·66
Pollard	£6 per ton (short)	0·72
Crushed Wheat ...	3s. per bushel (60 lbs.) ...	0·60
Oats	1s. 9d. per bushel (40 lbs.)...	0·53
Peas	5s. per bushel (60 lbs.) ...	1·00
Linseed Meal	14s. 6d. per 100 lbs. ...	1·74
Meat Meal	15s. 6d. per 100 lbs. ...	1·86

In Table III. will be found the values per lb. and per ton of home grown roughages as computed by substitution in Table I.

TABLE III.

VALUE OF HOME-GROWN ROUGHAGES AS DERIVED FROM RATIONS IN TABLE I.

Foodstuffs.	Value per pound. pence.	Value per ton. £ s. d.
Meadow Hay (Good)	0·44	4 2 4
Clover Hay	0·51	4 15 6
Green Maize	0·15	1 7 2
Green Lucerne (Bud stage)	0·16	1 9 3
Sudan Grass (2ft. high)	0·17	1 11 10
Silage (Mixed Cereals and Legumes) ...	0·15	1 7 8

Having arrived at a value for the various conserved materials, it may prove interesting to apply the results to a typical dairy herd and calculate the saving resulting from the use of such home-grown fodders.

RESULTS APPLIED TO A 20-COW DAIRY HERD.

Thirty-two tons of meadow hay will supply 20 cows with 20 lb. per head per day for six months. This would be worth £132 or £5 1s. 5d. per week for six months. If the value of *good* meadow hay was more generally recognised, it is believed that far more would be conserved.

CLOVER HAY.

Clover hay is one of the most valuable roughages which the dairy farmer can use. It is rich in protein and lime—two essential ingredients which are very often lacking. Thirty-two tons of good meadow hay will provide 20 cows with 20 lb. per day for six months. To purchase the equivalent nutrients would cost almost £6 per week or about £153 in all. This supports the argument that it pays to buy fertilisers to stimulate the growth of clovers and other herbage rather than to purchase foodstuffs in the lean months or allow cows to decrease in milk yield through lack of this fodder. It should be noted that clover hay and green maize can supply all the needs of a two-gallon cow, there being no need to purchase any foodstuff.

SILAGE.

In Ration 12 it will be noted that 30 lb. of silage are required. Assuming that silage is fed for four months of the year, 33 tons would be required to provide 20 cows with 30 lb. each per day. This silage would be worth about £45 or 27s. per ton according to the tables, but on most farms it would be worth much more. Calculations have here been made only on a food unit basis, no credit being given to silage for the valuable properties it possesses as a summer supplement in dry areas. In the Wheat Belt particularly, silage has a high dietetic value as a substitute for green food, which augments the food unit value considerably.

GREEN MAIZE.

Green maize appears in a very favourable light in these tables, and other green crops such as elephant grass or sorghums would obtain equal credit. This partly results from the fact that pasture is not considered. Where grazing or dried roughage is available in the paddock, maize would not be so valuable as here indicated, but where other roughages are scarce, as in suburban dairies, maize approximates in value to 27s. per ton. Green maize also has a dietetic value in addition to its food unit value—cows would yield better on Ration 7, which contains green maize, than on Ration 1 (chaff and bran) even though both rations supply the same number of food units.

If the maize is planted in rotation 2 to 2½ acres would supply 20 cows with 25 lb. per head per day, assuming an average yield of approximately 13 tons per acre (yields of 20 tons are not uncommon). Such a crop, according to Table III., would be worth about £36 or £2 5s. per week.

GREEN LUCERNE.

In contrast to maize, lucerne is somewhat under-estimated in value in the Tables. This apparent anomaly occurs because the rations in Table I. are mainly utilised to satisfy maintenance requirements. Maize is particularly suitable for this purpose, as a much lower percentage of protein is needed for maintenance than for production of milk. Lucerne being rich in digestible protein is eminently suitable to stimulate milk flow, and when rations for production are considered, lucerne will appear in a much better light. This Queen of summer fodder crops is more akin to expensive concentrates, such as linseed meal, than roughages such as cereal chaff. Lucerne also has a high dietetic value especially where other leguminous products are scarce.

Four acres of lucerne probably will supply ample material to give 20 cows 20 lb. of greenstuff per day for at least six months of the year. Even at the low estimated value given in Table III., such a plot would be worth £8 per month. The remarkable productivity of a small lucerne patch is not generally realised, and even a little lucerne during the summer months is a great stimulant to milk production.

SUDAN GRASS.

Sudan grass constitutes one of the best summer fodders which can be used in this State. It is hardy and drought resistant, and responds well to rotational grazing, each plant stooling out to form a strong tussock. If pure seed is used, sudan grass can be grazed at all stages of growth without any risk of sorghum poisoning, and cows will produce well while grazing on this fodder. The value of sudan grass is well shown in the tables eight acres sown to sudan and yielding

in the aggregate 10 tons of greenstuff per acre would be worth almost £130. Sudan grass is a cheap fodder to grow, and the produce does not require irksome handling as is the case with maize and lucerne.

From the foregoing it is quite apparent that the use of home-grown materials will result in considerable saving. The question of pasture has been avoided in this article, but it may be stated that a two-gallon cow on good mixed pasture should require no other food. As a matter of interest, it may be stated that the author has seen cows on good mixed pasture consistently yield 3½ to 4 gallons of milk per day without receiving any supplementary feeds other than hay. Good pasture is the best and cheapest food a cow can be given.

Some interesting information on the relative value of concentrates also can be gleaned from Table I. For example, Ration 5 shows that linseed meal makes the ration of a low-producing cow very expensive. In Ration 6 it will be seen why meatmeal has been advocated as a protein supplement—it is the cheapest protein concentrate on the market and, despite an initial dislike, cows will learn to eat this material which is only required in small amounts. Several farmers have advised that some cows will eventually eat meatmeal readily even when unmixed with any other material.

BEE STINGS—THEIR TREATMENT.

A CURE FOR RHEUMATISM.

H. WILLOUGHBY LANCE,
Apiculturist.

Many persons suffer unnecessarily from bee stings through lack of knowledge of how to deal with bees or how to treat the injury when stung.

Bees, like any other stock, vary in temperament, some strains being very vicious, attacking any intruders that come near their hives, but the majority are quiet and harmless until they are interferred with. When bees are gathering nectar or water, they concentrate on their job and take no notice of passers-by.

MANIPULATING HIVES.

The trouble usually starts when hives are interfered with, especially when there is a dearth of nectar. In opening up a hive, all movements should be slow and deliberate, injuring as few bees as possible, and not damaging combs of honey. Injured bees or honey from broken combs arouse the bees and put them on the defensive. Haste or signs of fear in the operator are quickly detected by the bees and may cause them to attack by dozens. If this should occur, walk away, passing behind bushes into a shady spot or building, and the bees will gradually be left behind.

If a bee succeeds in driving home its fiery dart, remove it as quickly as possible, but do not pull it out. The little white substance which is visible is the bag containing the poison, and if this is seized the poison is squeezed through the very small hollow tube into the flesh. The best way to remove it is to push it out sideways with the finger nail or the point of a knife.

REMEDIES FOR STINGS.

If honey is at hand, rub a little of this on to the stung spot. With some persons this is quite sufficient to counteract the formic acid of the sting, but others require further treatment. One of the best remedies is a little bi-carbonate of soda, which most housewives keep for cooking purposes, about as much as will go on a 6d. piece dissolved in a cup of hot water. Bathe the injured spot for some time, keeping the water as hot as possible, then rub in a good ointment, such as Rexona, Zambuk, etc. Repeat again in half an hour. This is quite harmless to the eyes or any portion of the body.

If discomfort persists, or any ill effects are felt, dissolve as much bi-carbonate of soda as will go on a threepenny piece in hot water, and drink. This may be repeated three hours later.

Other remedies are—the old-fashioned blue bag, a raw onion, ammonia, soda, tobacco juice, etc., but the bi-carbonate of soda will probably be found the most efficient.

To a beekeeper of any standing, stings are a part of his regular work, and he takes very little notice of them, as he has become so inoculated with the formic acid as to be nearly or quite immune. Cases have occurred, however, where beekeepers who have for many years been immune, have, in later life been very badly affected by stings and unable to work with bees.

MECHANISM OF THE STING.

It may here be worth considering the mechanism of the sting and the nature of the bee venom.

The stinging equipment of the bee consists of two glands which secrete the poison, a sack or reservoir for storing the poison, and the sting (which is a modi-

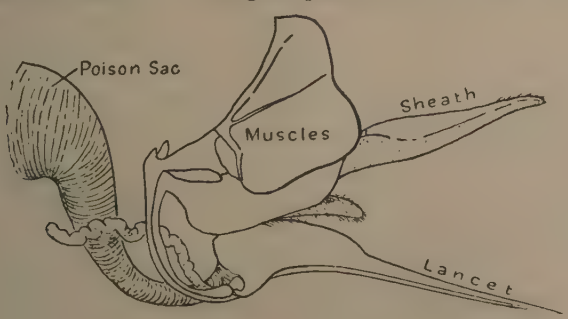


Fig. 1.

From "The Bee World."

fication of the ovipositor of ordinary insects). This sting itself, which is a wonderful instrument, consists of three main parts—a hollow, sharp-pointed, barbed lancet; the sheaths; and the muscles which actuate it. (See Figure 1.) The lancet

is sharper than the finest razor, stiffer than the best steel, yet non-brittle and flexible to the finest degree. At the tip of the sting the canal measures one-twelve-hundredth of an inch. (See Figure 2.) The whole action of the sting is a compli-

Fig. 2.

The tip of the sting magnified 600 times.

(*From "Gleanings in Bee Culture."*)

cated one. Suffice it to say that the muscles of the sting cause a backward and forward movement of the lancet, and at the same time cause a pumping action on the poison sack and inject the poison through the hollow tube into the punctured part.

BEE POISON.

The poison or venom is produced by two "acid" glands—long tubes with a tiny gland at the tip of each. Here the main bulk of the poison is produced and passed into the poison sack where it is stored. Then, as it is being ejected through the sting, it is joined by a small admixture from "alkaline" glands. Investigations by Langer and Flury show that the poison is a very complicated chemical substance and not only formic acid.

RESULT OF BEE STINGS.

The normal result of a sting is a small red area at the point where the sting entered surrounded by a larger white area. The actual pain at the seat of the sting usually only lasts a comparatively short time; with many persons this is followed later, as the poison spreads, with swelling around the injured part and irritation. Most beekeepers, however, become partially immune to the swelling and irritation and only feel the insertion of the sting like a red hot needle, so that a few minutes

after do not know where they have been stung. The human body, as is well known, is able to develop substances which neutralise poisons that are received in small quantities. These substances are known as "antitoxins." The blood of the average beekeeper contains antitoxins to bee poison which neutralise and form a remedy for bee stings. All, however, are not so fortunate, and even beekeepers have been known to become "sensitized" instead of "immunized."

Sensitized persons who are not used to being stung sometimes show serious and dangerous effects, such as shock and collapse, severe swelling and difficulty of breathing, or a hot flush, trembling, and great anxiety. These effects, however, are rare.

REMEDY FOR SERIOUS CASES.

Dr. Ray Jones, of Seattle, has made a close study of assembled medical knowledge of insect bites and stings. He states that in critical cases frequent hypodermic injection of one to one-thousand solution of epineprine prove effective, but that epineprine (formerly known as "adrenaline") is worthless unless given hypodermically. Sensitized persons may obtain immunity by a series of injections gradually increasing in strength. This treatment should, of course, only be given by doctors. For the average person, the remedies first mentioned usually give relief.

MEDICAL VALUE OF BEE VENOM: CURE FOR RHEUMATISM.

Bee venom fortunately has its beneficial side, and is a certain cure for many kinds of rheumatism. Dr. F. Thomson, England, states that "those types which come under the heading of muscular rheumatism—lumbago, fibrositis, and sciatica—are completely or partially cured in a large proportion of cases (the writer himself was thus cured in six weeks after 20 years suffering), and the writer kept a hive of bees in a small back yard behind his consulting room for curative purposes.

"At first one sting is administered, and if the patient is one of that very small band of unfortunates who are seriously affected by bee venom, this treatment is at once stopped.

"If the effects of the sting are normal, however, one or two stings twice weekly are advised.

"In other and more chronic forms of rheumatism, especially where definite joint changes have occurred, the proportion of beneficial results is small; but the method is well worthy of trial, and surprising cures are sometimes obtained.

"In some cases, too, the complications of sub-acute rheumatic fever yield to this form of treatment.

"The sting need not necessarily be applied to the part affected, though this often has a moral effect on the patient; the forearm is usually most convenient.

"The patient, further, may continue the treatment himself, by permission, at the nearest apiary."

Dr. Thompson states that 80 out of every 100 cases of rheumatism may be cured by a course of bee stings, but chronic forms of arthritis are not improved thereby.

In Germany there are several institutions that inject the bee venom hypodermically as a remedy for rheumatism. In Western Australia there are quite a number of person who have been cured of rheumatism by the simple method of allowing themselves to be stung by bees.

CALF CLUB MOVEMENT IN WESTERN AUSTRALIA.

G. K. Baron-Hay,
Superintendent of Dairying.

The Calf Club movement in Western Australia is comparatively recent, but indications are that the number of clubs which will be formed in the near future will rapidly increase.

The first Calf Club was inaugurated at the Yanmah School by the Head Teacher, Mr. Rourke, working in co-operation with the Agricultural Adviser for the district, Mr. M. Cullity. The first Field Day was held in November, 1931, when 40 calves were paraded for judging.

In 1933 Calf Clubs were formed at a number of centres throughout the South-West from Denmark to Boyanup. The credit of conceiving the holding of a Championship Calf Club Field Day must be given to the Donnybrook Dairy Farmers' Association working in close touch with Mr. M. Cullity of the Dairy Branch, Department of Agriculture. A Championship Field Day was held at the Donnybrook Show Ground on the Show Day organised by the Agricultural Society on November 15, 1933, when calves from nine District Calf Clubs were paraded before the judge. The calves, although mostly from grade cows, evidently had been excellently trained and prepared for the day. The ring craft shown by the children indicated weeks of training which would have enabled these stock to be paraded at any Agricultural Show in the State with credit to the owners.

I.—First Calf Club Parade in Denmark District. The Carmarthen Calf Club, November, 1932.

The conversation which the writer had with the parents from various centres indicated that uniform rules and conditions for each district were required, and a number of requests have been received for rules governing the formation of such Calf Clubs and which have prompted this article.

The idea of organising Calf Clubs is to imbue children with a love of animals—to create in them an interest in agricultural life and also develop a sense of responsibility. It has been found in other States, and by the interest evinced by adults in the parades which have been held in Western Australia, that not only do these Clubs tend to develop interest among the children but that parents and their friends also become deeply interested in the movement, and thereby a community spirit is developed with a strong bias towards the dairying industry.

It is essential for the success of a Calf Club that some active and enthusiastic resident of the district should be appointed the Club leader. In this respect the Head Teachers of the various schools have shown themselves keenly interested in the movement and, by reason of their influence with the children, generally make most suitable Club leaders. The Head Teacher also is able to supervise record books and correlate the ordinary subjects of the school curriculum with the work. This branch of rural education has the full support of both the Education Department and the Department of Agriculture, and the best results can only be obtained where close co-operation obtains.

II.—Memory Peak, Boyanup School Calf Club, and her champion heifer "Dawn." On the right is the First Prize, donated by G. F. Combs, Esq., "Brookvale," Jardee.

Dam, Brookvale Topper's Lulu: Production 4,438 lbs. Milk, 250 lbs. Butter Fat as senior 2-yr. old.

The following suggestions regarding the formation of Calf Clubs have given good results during the last two years:—

When it is desired to form a Club in a district, whoever is mainly interested (this may be an organisation or often the district School Teacher) should call a meeting of parents and others interested. The objects of a Calf Club should be explained, which are briefly as follows:—

(1) To create an interest in agricultural pursuits and, in this instance, to especially develop a dairying outlook in the community.

(2) To teach children the value of care and attention to feeding and the rearing of young stock.

(3) To develop a sense of responsibility among children.
All the work involved in feeding, grooming and looking after the calf should be performed by the youthful owner. This will develop a spirit of reliance and—ultimately—of pride in his own herd.

(4) A record book giving a weekly record of the life of the calf and also a detailed statement of revenue and expenditure should be kept. This phase of agriculture generally needs special encouragement.

(5) A spirit of healthy rivalry and desire to excel is created, and members by meeting on Field Days are taught to become competent judges and to appreciate the faults in their own stock as well as the good points, which develops broad-mindedness and tolerance among the children.

III.—Masters T. A. Langridge, W. H. Langridge and Miss I. M. Langridge—First, Second and Third respectively in the parade from five Calf Clubs organised by the Donnybrook Dairymen's Association.

While it is not possible to lay down rules which may be applied in toto for each district, the following are suggested:—

(1) The Calf Club shall be called the.....Club.

(2) A committee of five members shall be appointed, the convenor of the meeting or the Head Teacher of the School to be Chairman.

(3) A meeting shall be held once monthly.

(4) It shall be the responsibility of the committee to arrange for lectures, Field Days, and the conveyance of members where necessary, also to arrange for an Annual Field Day and any general Club business that may arise.

One or more keen and practical farmers may be appointed to visit and assist the children with advice and to see that calves are being correctly reared by the children.

It is suggested that only heifer calves shall be owned by Club members. This facilitates judging at field gatherings, and heifers are less likely to injure children.

Club members shall be grouped into two divisions:—

(a) Children under 8 years.

(b) Children from 8 to 16 years.

(5) A record book should be kept giving a careful account of the rearing of the calf and any other particulars thought desirable, also with a record of expenditure and receipts.

(6) Every member should undertake to exhibit stock at the Annual Field Day.

(7) At the Annual Show calves shall be judged according to the following points:—

Pure breed type or dairy type	50 points.
Appearance and age development	20 „
Leading and ring craft	15 „
Book-keeping and records	15 „

This scale allows 50 points for the quality of the calf, whilst 50 points are allotted for the work carried out by the member. This is to avoid the owner of an excellent "breed type?" calf winning the prize, even although the calf may not have been reared as well as animals of less high quality.

Field Officers of the Dairy Branch, Department of Agriculture, may be consulted at all times regarding the formation of Calf Clubs and can assist by lectures and demonstrations in the judging of, and systems of rearing, young dairy stock.

IV.—His Excellency, the Lieutenant-Governor, Sir James Mitchell, K.C.M.G., presenting "Brookvale" and his pedigree to Memory Peak, owner of the champion's calf.

THE SUPPRESSION OF BUSH FIRES.

By A. C. Shedley, B.Sc., Dip. For.

(Published by the courtesy of the Australian Broadcasting Commission, being an educational talk given through Station 6WF.)

Fire control organisation is a local problem, but certain broad principles have general application, and the two most important are undoubtedly early detection of outbreaks, and rapid transport of a fire fighting force to the scene of the fire.

It may be interesting to learn of the methods adopted to locate fires in this and other countries.

Under W.A. conditions in the forest areas early detection is secured by the erection of lookout towers on high points at intervals of 15 to 20 miles apart, and these are manned continually during the summer months.

The method of locating a fire in general use is by the cross bearing system; the bearings taken from two lookout towers being transmitted over the telephone to headquarters, where they are plotted on a district plan. The intersection of the bearings gives the position of the fire which in this case can be roughly placed without actually being seen.

In some cases only one tower is manned when fires are spotted by the use of the range finder. With the single range finder system, the exact location of a fire cannot be obtained unless the actual site can be seen from the tower, because it is only possible to range on to some definite object such as a tree and not smoke.

The position of fires hidden by ridges from the tower, and the higher smoke only of which can be seen; can only be estimated, but the tower man from his knowledge of the country and familiarity with the panorama after he has been stationed on the tower for some little time can give the position of the fire with extreme accuracy.

On occasion when the fire danger is particularly acute or the visibility very poor, owing to the pall of smoke, it has been found necessary to send out patrols to aid in location. In Victoria the Forests Commission is assisted on such days of abnormally bad weather conditions by the Air Force sending out aeroplanes equipped with wireless apparatus chiefly for detection purposes. In Canada, the use of aircraft both for detection of fires and transport of personnel and equipment to fires has developed tremendously and is now generally recognised as the only effective method in those parts of the Northern forest country where the topography is not rugged and where the interspersed lakes provide numerous landing grounds.

In cleared country in the agricultural districts, the detection of fires is a comparatively simple matter, because of the uninterrupted view afforded by the clearing.

Having located it, the next step is to reach the fire, and the sooner it is reached the easier will it be extinguished. Before leaving for the scene of the outbreak, however, if possible word should be sent to neighbours in order that no time is lost in securing assistance.

To deal effectively with a bush fire it is necessary to know that a fire burns in one of two general ways: 1. A long oval; when burning before a wind it always starts with a narrow area and travels more or less rapidly with an ever broadening area; 2. Circular; where there is little or no wind it burns slowly away from the starting point with equal intensity in all directions.

Except when the atmosphere is absolutely still, every fire has three distinct parts (1) the head fire; (2) side fires; and (3) the tail fire.

The head fire is the portion which travels before the wind; it is most active, most destructive and the most rapidly moving portion.

Before attempting to do any fire fighting, reconnaissance should be made to determine the extent and head of the fire, topography of the country, the location of any burnt areas, swamps, etc., into which the fire might be "headed," highly inflammable areas to be avoided, and the position of tracks or roads which might be used in back firing.

Bush fires should invariably be attacked from the front to control the head fire first, otherwise this is continually making a wider line and a greater volume. It is rarely possible to work fast enough from behind to overtake the head fire.

Fire travels fastest up-hill, and that portion travelling up-hill being assisted by the natural draught upwards develops into a head fire and must be dealt with as such.

It is seldom that direct beating of the head fire can be undertaken with any hope of success in any bush other than that burnt 12 months or 2 years previously. Raking tracks or making use of existing roads from which to back fire is the only safe method in inflammable bush, grass or stubble country unless of course night fire fighting is carried out. Anyone who has had to do with fire control is well aware of the fact that under normal circumstances, the late night or early morning hours are those during which fire intensity is least. This is due to the higher relative humidity; the lower temperature, and the decreased wind velocity. There are, however, difficulties in fire fighting in the darkness, but miners' acetylene head lamps have been tried and found very helpful.

Tools used for attack are rakes, which are invaluable, shovels for cutting scrub and covering burning logs and some sort of beater, either a dense bush cut from a green tree (a marri or red gum bush is very useful), bags or a specially made beater recommended by the Bush Fire Brigades in South Australia. The latter, which are most useful in clean country, are made of leather 12in. x 8in. firmly secured to a strong, but light handle, and are found to be much more effective than bushes or bags.

The beating should always be directed at the extreme edge of the burning and towards the burned area so that sparks may not be spread to the unburned ground.

The patrol of fires to "mop up" (to use an old war term) after the first attempt at extinguishing them is a very important duty, because of the necessity of dealing with fresh outbreaks as they occur, and only reliable men should be detailed for such work. In back firing also it is necessary to patrol the fire to see that it does not cross the often narrow path which has been made by raking.

For use in clearing a narrow track on rocky ground from which to burn back, the Forests Department has developed a horse drawn scraper which can be constructed by any country blacksmith. It consists of a six foot length of railway rail (45 or 60 lbs.) bent at an angle of 60 degrees to form two sides of a triangle. The use of this scraper eliminates much hand raking.

The main method of attack therefore must be counter-firing from existing or improvised fire lines, particularly in scrub country where it is impossible to come within at least a chain of the highly inflammable scrub. Where it is possible to get close to the fire in grassed areas, or where the scrub is light, or at night when the fire is being put out, a method in use is to extinguish the fire with earth thrown on with long-handled shovels, and with a little practice extreme accuracy of aim and efficiency of distribution of the earth is obtained.

Experiments with knapsack tanks for water have been conducted by the Forests Department and two trucks have been fitted with water tanks and semi-rotary pumps with hose lead.

It has been found that the use of water is far more efficient than soil, and has given every satisfaction; it is possible for a man to extinguish the fire as fast as he can walk, even in thick scrub but it is necessary for the water carriers to be followed up by a second wave of "moppers up" sweeping in the burned edges, as "flash-backs" are common, and if not watched may nullify the efforts of the gang putting out the fire; in this connection, it is of course necessary for every method to be followed up to deal with "flash-backs," which are more common with water than when soil has been thrown on the fire. The advantage of the use of water lies in the fact that it is much more rapid in its effect than soil.

The one big disadvantage with the knapsack tanks is that the supply of water is not inexhaustible, and valuable time is lost in refilling. This can be overcome in part by the provision of reserve supplies of water in tanks placed as close as possible to the actual site of the attack. One very valuable use for these tanks lies in the ability of the men using them to get close enough to a fierce outbreak to cool it down sufficiently to enable a man with a shovel to approach and extinguish it with soil or by beating.

The knapsack tank consists essentially of a 4-gallon galvanised iron container to which is fitted a short length of hose and hand pump with nozzle by means of which a stream of water can be forced a distance of 20 or 30 feet. It has been found invaluable for extinguishing burning logs and trees which are a constant source of danger in starting fresh outbreaks if not effectively controlled.

In addition to these knapsack tanks, water tanks with semi rotary pumps mounted on motor trucks and spring carts operate in forest districts for fire protection. They have proved very useful as they can be stopped some distance from a blaze and yet the water can be forced on to the fire. Tanks could be used with advantage in country districts if they were provided at convenient centres where they could be loaded on to lorries when required.

Tests are being conducted in W.A. with chemicals, the most important of which is potassium carbonate dissolved in water in varying amounts to an imperial gallon and used in the knapsack tanks. It has been found that even with a 3lb. solution the fire is blackened right out, and does not break out again as it frequently does when water alone is used. Also the solution will put out a greater area of fire, resulting in a saving of water, an important factor in the dry areas of the State.

To deal with the bush fire problem in country districts, co-operative effort is absolutely essential if effective control is to be achieved, and for this purpose bush fire brigades have been formed all over Australia.

In Victoria as far back as 1931, the number of bush fire brigades had reached 224, and these organised voluntary brigades are now distributed throughout the populated sections of the State. Self help in all cases has been encouraged and each brigade provides its own equipment, usually by a levy on landowners at the rate of 1s. per 100 acres, whilst in some cases a membership fee of approximately 10s. per annum is charged to members. In the case of brigades operating in the vicinity of forest reserves, however, the Forestry Commission assists by a donation of certain apparatus, stipulating that members help with the extinguishing of fires in adjacent State forests.

In South Australia, a number of brigades have been formed, the chief of which are those in the vicinity of Wirrabara and Jamestown in the north where a very high standard of efficiency has been reached, and good work accomplished both from the point of view of the farmers and the Forests Department in minimising the losses caused by bush fires of many thousands of pounds. In these centres the settlers have become quite enthusiastic as they realise that proper fire organisation is the only way to combat the bush fire menace.

The South Australian Amended Bush Fires Act of 1913, gave the necessary power to District Councils—corresponding to our Road Boards—to appoint up to ten persons as special officers whose duties are to prevent and control fires. These officers or fire controllers, as they are called, are granted very wide powers in case of outbreak of fire in the particular district in which they are appointed. The Controller is empowered to take any action he may think fit in combating an outbreak of fire, and can authorise the burning of a fire break to stem an approaching fire or to use other preventative measures, which at times might mean the burning of another man's property.

In the case of some districts committees are also appointed, the duties of the members being to rally forces to the scene of action, undertake the responsibility of provisioning all of the fire fighters with food and drinking water. A depot is established in each main township at which a supply of water containers and fire beaters is kept ready for action.

The committees also undertake propaganda work and the distribution of linen posters bearing the name and addresses of fire controllers and committeemen with instructions to the public as to how to proceed in case of an outbreak of fire. In addition, valuable advice is given to farmers in the district about the ploughing of firebreaks, the protection of homes, stables, etc., the provision of fire fighting equipment and bush fires legislation.

DAIRY CATTLE IMPROVEMENT ACT, 1922, and AMENDMENT ACT, 1932.

G. K. Baron-Hay,
Superintendent of Dairying.

The Dairying Industry in Western Australia may be said to have passed through two very definite periods:—Firstly 1895-19, may be conveniently called the "**Stationary Period,**" and secondly 1919-1933, the "**Period of Growth.**"

The following figures indicate the position in 1919-20 quite clearly:—

Table No. 1.

Number of Cows	42,563		
Milk Production	9,619.238 gallons.		
Yield per Cow	226 Gallons milk = 90·4 lbs. Butter Fat.		
Acres of Sown Pasture ...	16,672		
Acres per Cow	·39		
Imports of Butter	6,606,000 lbs. (approx.)	at 2s. 3d. lb. ...	£743,175
„ Cheese	1,143,005 „	at 1s. lb. ...	£57,150
„ Condensed and Dried Milk	3,508.501		£127,689
			£928,014

The picture presented by these figures is anything but a cheering one.

The yield per cow was exceedingly low and made dairy farming quite unprofitable except at uneconomically high prices for produce, which as a matter of fact, were ruling at the time, the average price for butter fat during 1920, being approximately 2s. 3d. per lb. Moreover, the area of pasture available per cow unit in the State was only .39 acres, while on the average dairy farm an area of 4.75 to 5 acres is required to provide a sufficiency of fodder for a cow unit.

It appears obvious that in 1919-20 there were two very weak spots in the economic position of the industry, namely:—(1) Inadequate arrangements for feeding the cow; (2) The low average production of dairy cows.

Improvement, it was thought could be brought about by improved "Feeding" methods and a definite policy of "Breeding."

The object of the present article is to show what results have been obtained from measures to strengthen the second of the weak spots mentioned above.

It is generally recognised that a definite policy in "Breeding" is essential before any permanent increase in average or individual production can be obtained. The policy of using registered pure-bred sires to improve the average yield of the progeny of common stock has been proved time and again.

Only one striking example as illustrating the effect of this policy on large numbers of dairy cows need be given:—

Table No. 2.

25,000,000 COWS IN THE UNITED STATES OF AMERICA.

	Percentage Pure-Bred Bulls.	Average Production of Milk per Cow. Gallons.
1st Group of 12 States	51 ...	410
2nd Group of 12 States	31 ...	330
3rd Group of 12 States	19 ...	260
4th Group of 12 States	12 ...	200

This shows the result from dividing the United States of America into four groups of twelve States each, according to the percentage of pure-bred bulls heading dairy herds, in a census taken 10 years ago.

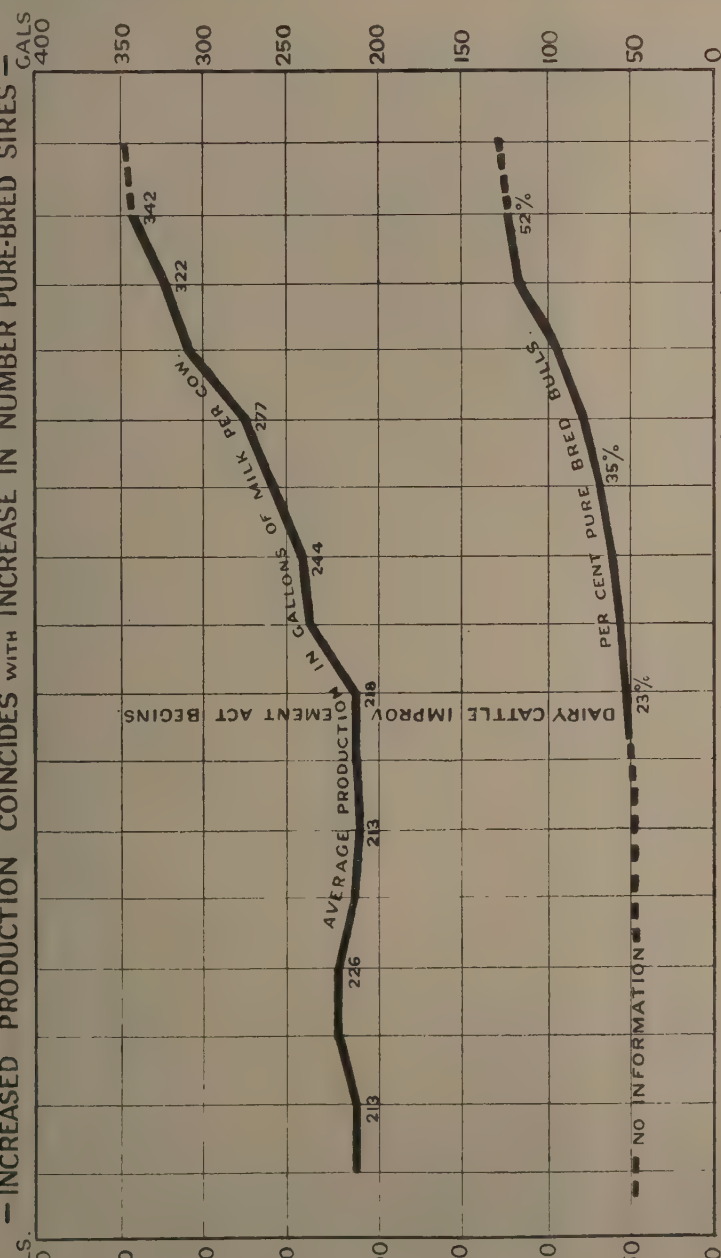
Group No. 1 with an average of 51 per cent. pure sires, recorded an average production of 410 gallons of milk per cow per annum; Group No. 2 with an average of 31 per cent. pure sires, showed an average production of 330 gallons per cow; Group No. 3 with an average of 19 per cent. pure sires averaged 260 gallons per cow, and Group No. 4 with an average of 12 per cent. pure sires, showed an average production of 200 gallons per cow. These figures, representing as they do, the result of the production of nearly 25 million dairy cows should be of importance elsewhere in showing that increased production follows the use of pure-bred sires.

It is instructive to compare the position in Western Australia in 1919 with that in 1932, as is shown in Table No. 3:—

Table No. 3.

Year.	Gallons of Milk per Cow.	Percentage Pure-Bred Bulls.
1919–20	226 ...	20 (estimated)
1924–25	218 ...	23
1928–29	277 ...	35
1929–30	316 ...	...
1930–31	322 ...	...
1931–32	342 ...	52

It will be noted from Table No. 3 and more clearly from the Graph below that the yield of the average cow in Western Australia has increased by 57 per cent. during the period, whilst the percentage of pure-bred bulls has steadily increased from 23 to 52.



Undoubtedly increased pasture available has contributed to the improvement, but it must be noted from the Graph that between the years 1918 and 1925 no increase in the average production is discernible, although there was a very big increase in the acreage of pasture available, namely, from 20,000 acres to over 80,000. This is a further indication of the premise mentioned before that the foundation of all permanent increase in production is along the lines of "breeding," as however much fodder is available for cows whose capacity for production is low, the desired increase will not be obtained. It will further be noticed from the Graph that the steady upward trend in production commences with the introduction of the "Dairy Cattle Improvement Act."

The following information regarding the requirements under the Act is given for the information of those farmers who are not yet conversant therewith.

Dairy farmers generally uphold the provisions of the Act as it is recognised that by the adoption of the principles underlying its administration the average production per cow will be increased and, conversely the average cost of production will be decreased.

1. The prescribed area for the operation of the Acts is the **South-West Division** of Western Australia (which is that portion of the State that can be bounded by a line drawn from a point on the West coast slightly north of Gantheume Bay, eastward along the Murchison River to Ballinoo Spring, due south to Tallering Peak; south-east to Mt. Gibson, east to the No. 1 Rabbit-proof Fence, south along the Fence to Burracoppin, thence south-east along the Fence to the south coast at approximately Bedford Harbour).

2. The Acts provide that **ALL BULLS OVER THE AGE OF NINE MONTHS** in the area described in paragraph No. 1, **MUST BE REGISTERED**, with the exception of pedigree beef strain animals kept solely for beef production, which may be exempted on application to the Director of Agriculture.

CERTIFIED PURE-BRED BULLS should be registered for **LIFE**, the fee being **10s. per head.** This refers to bulls whose parents are entered in the Breed Herd-book.

GRADE BULLS should be registered **ANNUALLY**, the fee being 5s. per head with each application. This registration refers to all animals for which no pedigree can be produced or whose parents are not in the Herd-book.

3 The prescribed fee should be forwarded with each application.

4. Registrations are **due on 1st January** and should be effected not later than the 21st: new registrations become due as the bulls reach the age of nine months throughout the year.

5. Registrations of **Grade** bulls should be renewed annually on or before the 21st January. The **registration year** dates from **1st January to 31st December,** irrespective of when effected during the year.

6. Owners should notify the Department in writing, quoting the disc number, immediately any registered bull is,

(a) **Transferred**—in which case the name and address of the new owner should be furnished;

(b) **Sold for slaughter, castrated or deceased,** in order that the registration may be cancelled.

7. **Failure to register** or to notify the Department in accordance with paragraph No. 6, constitutes an offence against the Act, rendering the offender liable to a penalty of £20.

8. The disc number should be quoted on applications for re-registrations.

9. When lodging an application for the first time the applicant should supply, if possible, the name of the previous owner and the breeder.

10. In the event of application forms not being available the particulars may be submitted by letter, but full details of breeding, age, etc., should be furnished.

11. **No disc can be transferred to a bull other than the animal** for which it is issued, and once registered a bull retains the same disc number even though he may change ownership.

The disc should be attached to the left ear, and in the event of sale, should be passed on to the purchaser, together with the certificate of registration.

12. Registration may be refused unless the bull be well-grown according to age, sound in constitution and manifestly showing evidence of the breed characteristics of one of the following dairy breeds:—

Ayrshire, Jersey, Friesian, Red Poll, Guernsey, Dexter Kerry, Holstein, Milking Shorthorn, Kerry.

By carefully observing the foregoing, owners will greatly facilitate the administration of the Act.

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS FOR MONTHS OF SEPTEMBER, OCTOBER, AND NOVEMBER, 1933.

—	SEPTEMBER.				OCTOBER.				NOVEMBER.				
	6th.	13th.	20th.	27th.	4th.	10th.	18th.	25th.	1st.	8th.	15th.	22nd.	29th.
Sheep...	12,870	12,992	14,238	15,734	19,125	13,241	17,027	17,816	17,326	18,871	12,778	9,569	10,333
Cattle	578	475	529	445	405	511	637	723	661	605	626	558	544
Pigs ...	1,440	1,825	1,785	1,801	2,126	1,127	2,123	1,681	1,664	1,502	1,227	1,155	1,264

COMPARATIVE VALUES PER POUND.

Mutton	4½d.	4½d.	4½d.	4½d.	4d.	2½d.	3½d.	3½d.	3d.	2½d.	2½d.	Nil.	3½d.
Beef ...	3½d.	3½d.	4d.	4½d.	5d.	5½d.	5½d.	4½d.	3½d.	4d.	4d.	3½d.	3½d.
Pork ...	5½d.	5½d.	5½d.	5½d.	5½d.	5½d.	5½d.	5½d.	5d.	5½d.	5½d.	5½d.	6½d.
Bacon	5½d.	5½d.	5½d.	5½d.	5d.	5d.	5d.	5d.	4½d.	5d.	5½d.	5½d.	5½d.

MARKET REPORT.

Messrs. H. J. Wigmore & Company, Limited, of Wellington Street, Perth, have supplied the following information regarding the chaff, oats and wheat available for auction at the Perth Railway Yards, for the period September to November inclusive.

September.—720 tons of chaff. F.a.q. to prime was selling freely at £5 2s. 6d. to £5 10s.; f.a.q. at £4 15s. to £5 per ton. Mediums were finding buyers at £4 7s. 6d. to £4 10s. Prime oaten chaff was selling at £5 2s. 6d. to £5 5s.; f.a.q. at £4 15s. to £4 17s. 6d.; mediums from £4 7s. 6d. to £4 10s. per ton.

Oats.—Good heavy feeds were changing hands at 2s. 3d. to 2s. 4d.; good feeds from 1s. 10d. to 2s. 1d.; light feeds from 1s. 6d. to 1s. 7½d. per bushel.

Wheat.—F.a.q. was realising from 3s. 4d. to 3s. 5d.; second grade from 3s. to 3s. 2d. per bushel.

October.—730 tons of chaff. F.a.q. to prime wheaten chaff was making from £5 to £5 5s.; f.a.q. from £4 12s. 6d. to £4 15s.; medium quality from £3 15s. to £3 17s. 6d. per ton. Prime oaten chaff changed hands at £4 17s. 6d. to £5 2s. 6d.; f.a.q. from £4 10s. to £4 15s.; mediums at around £4 5s. to £4 7s. 6d. per ton.

Oats.—Good heavy feeds found buyers from 1s. 11d. to 2s.; good feeds from 1s. 9d. to 1s. 10d.; light feeds from 1s. 6d. to 1s. 8d. per bushel.

Wheat.—F.a.q. was making from 3s. 0½d. to 3s. 1d.; second grade from 2s. 9d. to 2s. 10d. per bushel.

November.—665 tons of chaff. At the beginning of the month f.a.q. to prime wheaten chaff was selling at £4 12s. 6d. to £4 15s.; f.a.q. from £4 7s. 6d. to £4 10s. per ton; mediums at £3 7s. 6d. Towards the end of the month new season's wheaten chaff was finding its way on to the Perth markets, and consignments of f.a.q. to prime were selling at £3 17s. 6d. to £4 5s.; f.a.q. form £3 12s. 6d. to £3 15s. per ton. Prime oaten chaff was changing hands at £4 10s. to £4 12s. 6d.; f.a.q. from £4 2s. 6d. to £4 5s.; mediums at around £3 12s. 6d. per ton.

Oats.—Fair supplies were arriving for auction, and the market eased. Good heavy feeds were realising from 1s. 10d. to 1s. 11d.; good feeds from 1s. 7d. to 1s. 9d.; light feeds from 1s. 5½d. to 1s. 6½d. per bushel.

Wheat.—F.a.q. was finding buyers at 2s. 11d. to 3s. 0½d.; second grade from 2s. 6d. to 2s. 9½d. per bushel.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	SEPTEMBER.						OCTOBER.						NOVEMBER.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	73·0	84·8	47·6	38·5	1·35	1·62	74·5	89·6	50·1	42·0	1·63	0·97	89·1	104·7	59·7	46·7	0·28	0·31
Geraldton	72·6	87·8	52·7	44·0	·74	1·37	73·7	91·0	56·4	45·0	1·81	0·71	84·3	103·0	61·7	46·2	0·01	0·25
Walebing	68·5	83·6	44·9	35·3	1·32	2·17	72·4	90·0	45·9	35·4	1·86	1·37	85·1	105·2	55·4	41·2	0·50	·52
Perth	68·6	86·7	50·4	44·0	2·62	3·45	69·2	83·0	53·0	42·0	5·09	2·19	80·3	99·2	59·1	47·6	0·24	0·78
Kalamunda	68·0	83·8	48·6	42·1	3·49	4·72	67·1	87·0	50·5	40·9	5·34	3·12	81·1	104·2	56·6	44·3	0·20	1·00
Bunbury	66·8	82·7	48·1	42·0	3·27	3·64	67·9	80·7	51·0	39·3	3·68	2·41	75·9	91·2	53·9	40·0	0·22	0·99
Bridgetown	67·2	85·0	41·5	32·0	4·00	3·97	68·8	82·0	46·0	34·9	4·46	2·97	78·8	97·0	46·7	35·0	0·50	1·12
Albany	65·3	79·0	48·8	43·0	3·69	4·18	67·6	83·0	50·2	43·6	6·26	3·19	70·0	81·6	53·5	43·4	1·77	1·43
Merredin State Farm	69·8	83·8	43·2	32·3	·49	1·13	74·0	94·5	46·4	3·23	·85	·91	77·2	100·7	55·4	43·0	0·42	0·43
Northam	70·6	87·6	44·9	37·0	·88	1·63	72·7	89·6	48·2	38·0	1·86	1·03	84·9	104·3	55·4	44·8	0·05	0·38
York	69·7	85·8	41·9	34·0	1·15	1·61	72·2	90·0	46·3	36·0	2·21	1·08	83·2	103·0	52·8	40·0	0·05	0·41
Narrogin State Farm	65·8	79·6	42·7	36·0	1·50	2·24	67·9	84·7	44·8	33·8	1·90	1·47	79·9	99·6	49·4	34·6	0·07	0·54
Katanning	65·2	81·0	43·0	34·6	1·56	1·97	67·8	81·3	46·6	36·7	2·22	1·55	77·9	98·0	49·9	37·2	0·59	0·66
Cape Leeuwin ...	64·4	81·8	54·1	47·0	4·05	3·47	64·5	76·8	55·1	45·0	5·23	2·88	69·0	90·0	57·8	49·5	0·61	1·22

QUARTERLY NOTES.

September rainfall was generally below the average, and at the end of the month crops generally were in need of a good soaking rain. October 1 to 4 saw these rains materialise; the falls being immensely valuable to both early and late sown crops. At the end of the month crops were everywhere well forward and on the whole, gave promise of excellent yields. November was a month of very slight rainfall except at the end of the month, when thundery conditions prevailed and fairly heavy rain fell over some of the North and North-Eastern country with hail, which caused considerable damage at a few sections. No doubt these rains did a certain amount of harm, but on the other hand, the water catchments, which were low would have been replenished. Harvesting was in full swing with good results. The cold weather with occasional rain had hindered farmers to a great extent, while owing to the heavy winds, losses through grain shedding had occurred.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE

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No. 177.—*Lotus Major.*
No. 178.—*Star Thistle.* W. M. Carne, F.L.S. and C. A. Gardner.
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No. 200.—*The Registration of Bulls under The Dairy Cattle Improvement Act,* 1922.
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